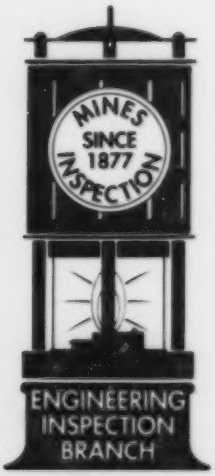
Ministry of Energy, Mines
and Petroleum Resources
Hon. Jack Davis, Minister

MINING IN BRITISH COLUMBIA 1986 - 1987



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2) MINE PRODUCTION

MINING IN BRITISH COLUMBIA

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FOREWORD

This volume continues a record of mining activity in British Columbia dating back to 1874.

From 1874 to 1968, the Annual Report of the Minister contained all statistics relating to metals, industrial minerals, placer gold, and coal, as well as descriptions of mines and mining activity and the full report of the Chief Inspector of Mines. However, by the late 1960s the sector had expanded greatly and attempting to include all such descriptions in a single volume rendered the publication large and unwieldy. Consequently, from 1969 onward the information was produced in several publications.

Descriptive material was published in Geology, Exploration and Mining in British Columbia (GEM) as a single volume. In 1975, descriptions of mines and production activity were eliminated and GEM was broken down into separate publications. The Annual Report of the Minister continues to provide an overview of the sector and the Ministry's activities.

The Annual Report of the Chief Inspector of Mines was published in full until 1974. After 1974 the Report was reduced in scope, with the deletion of descriptions of fatal accidents and dangerous occurrences, certifications, etc.

In order to provide a complete record of activity, Mining in British Columbia, 1975-1980 was produced. These two volumes were designed to accompany GEM and the Annual Reports of the Minister. Volume I - Mine Production provides the location, a brief description, a summary of activity, and production statistics for all major metal, non-metal, and coal mines in British Columbia. Volume II - Report of the Chief Inspector contains details of mine inspection and safety practices in mining, and provides an account of the work of the Inspection and Engineering Branch relating to all phases of mineral production. The subsequent publication Mining in British Columbia, 1980-1985, provided the same information in one volume.

This volume continues to use a format similar to that used in earlier editions of Mining in British Columbia. It will be noted, however, that the Report of the Chief Inspector is now presented as Part 1, followed by Mine Production, Part 2, to reflect the emphasis the publication wishes to place on the work of the Engineering and Inspection Branch.

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PART 1 - REPORT OF THE CHIEF INSPECTOR

INTRODUCTION

The Engineering and Inspection Branch carries out activities to provide safe operations at all mines, to ensure worker health and safety, and to ensure suitable reclamation and conservation of land affected by mining and exploration. Most activities are required and carried out under the Mines Act, the Mines Regulation and the Coal Mines Regulation.

During the year, inspectors stationed at various locations inspect coal mines, metal mines, sand and gravel pits, placer mines and quarries in accordance with the Mines Act and the prescribed regulations. Specialized research and support for field inspections is provided by Victoria-based professionals in the areas of reclamation, environmental control, geotechnical engineering, mechanical-electrical engineering and coal mining.

Figure 1 shows the Inspection Districts and the location of District and Other Offices. The mailing addresses of the offices are as follows:

Fernie
Bag 1000, Fernie, B.C., V0B 1M0.
Tel. (604) 423-6884.

Kamloops
101-2985 Airport Drive, Kamloops, B.C., V2B 7W8.
Tel. (604) 828-4566.

Nelson
403 Vernon Street, Nelson, B.C., V1L 4E4.
Tel. (604) 354-6125.

Nanaimo
1A-3411 Shenton Road, Nanaimo, B.C., V9T 2H1.
Tel. (604) 755-2486.

Prince George
1652 Quinn Street, Prince George, B.C., V2N 1X3.
Tel. (604) 565-6125.

Smithers
Bag 5000, 3793 Alfred Avenue, Smithers, B.C., V0J 2N0.
Tel. (604) 847-7383.

Vancouver
150-800 Hornby Street, Vancouver, B.C., V6Z 2C5.
Tel. (604) 660-9363.

Victoria
105-525 Superior Street, Victoria, B.C., V8V 1X4.
Tel. (604) 387-3781.

MINING INSPECTION DISTRICTS AND OFFICES

District	Office
1, 2	Smithers
9, 10, 11	Prince George
7, 8	Nanaimo
3, 4, 15, (14)	Kamloops
5, 14	Nelson
6, 12, (5)	Fernie

● District and other offices

Figure 1

STAFF

Branch personnel during 1986 and 1987 was as follows:

Fernie:

A. Whale, Inspector of Mines and Resident Engineer
R. Booth, Inspector of Mines and Resident Engineer
G.A. MacDonald, Mechanical Inspector
P.J. Switzer, Inspector of Mines (Mine Rescue)

Fort St. John:

E.J. Hall, Reclamation Inspector

Kamloops:

F.J.T. Hancock, Inspector of Mines and Resident Engineer
E. Sadar, Inspector of Mines and Resident Engineer
J.P. MacCulloch, Inspector of Mines and Resident Engineer
R. Heistad, Mechanical Inspector
B.A. McConachie, Inspector of Mines (Mine Rescue)

Nanaimo:

J.W. Robinson, Inspector of Mines and Resident Engineer
H.A. Armour, Inspector of Mines
R.F. Brow, Inspector of Mines (Mine Rescue)

Nelson:

M.A. Mellor, Inspector of Mines
A.L. O'Bryan, Reclamation Inspector
E.C. Ingham, Inspector of Mines (Mine Rescue)

Prince George:

R.W. Lewis, Inspector of Mines and Resident Engineer
D. Turner, Inspector of Mines and Resident Engineer
J.J. Sutherland, Inspector of Mines
B.A. Gordon, Reclamation Inspector
K. Hughes, Mechanical Inspector

Smithers:

V.A. Pakalnis, Inspector of Mines and Resident Engineer
B. Good, Inspector of Mines and Resident Engineer
D. Flynn, Inspector of Mines and Resident Engineer
J.E.A. Lovestrom, Inspector of Mines (Mine Rescue)

Vancouver:

B.M. Dudas, Inspector of Mines and Resident Engineer
S.J. Hunter, Inspector of Mines
R. Kumar, Environmental Control Inspector
V. Pyplacz, Environmental Control Inspector (Audiology)
A. Parker, Environmental Control Inspector (Noise)

Victoria:

V.E. Dawson, Chief Inspector of Mines
R.A. Fyles, Manager, Inspection Services, South
T. Vaughan-Thomas, Manager, Inspection Services, Coast
R.W. McGinn, Manager, Inspection Services, North
T.G. Carter, Senior Mechanical-Electrical Inspector
R.F. King, Electrical Inspector
J.E. Brenner, Roads Supervisor
D.J. Murray, Senior Environmental Control Inspector
J.C. Errington, Senior Reclamation Inspector
D.M. Galbraith, Reclamation Inspector
R.T. Martin, Senior Geotechnical Inspector
J.E. Beswick, Reclamation Inspector (Victoria/Kamloops)
R. Bone, Inspector of Mines and Resident Engineer
P.J. Lindsay, Office Administrator

STAFF CHANGES

Additional 1985 staff changes not listed in the previous report include Bruce Lang's retirement in July after 15 years of service in the Nelson office, and S. Ghoneim's resignation in December, from the Ministry in Prince George, to return to school.

1986

Victor Dawson, who had been designated Chief Inspector in 1985, obtained the position permanently on January 23, 1986.

Bryan Good and Doug Flynn joined the Ministry in Smithers in January and March, 1986, respectively. Both are Inspectors of Mines and Resident Engineers.

In March, Dick Fyles was appointed to the newly created position of Manager, Inspection Services, South, headquartered in Victoria.

1987

Victor Pakalnis retired from the Smithers office at the end of January after seven years with the Ministry.

Early in the year, Ed Beswick was transferred from Victoria to the Kamloops office.

In April, Patrick Lindsay joined the staff in Victoria as the Office Administrator.

BOARDS OF EXAMINERS

Mines Other than Coal Mines

V.E. Dawson	Victoria
B.M. Dudas, member	Vancouver
E. Sadar, member	Kamloops

This Board of Examiners consists of the Chief Inspector as Chairman and two other inspectors appointed by the Minister as members. Under the Mines Act, the Board conducts the examination of applicants for underground and open pit shiftboss certificates, and issues certificates at all mines other than coal mines.

Coal Mines

V.E. Dawson, Chairman	Victoria
T. Vaughan-Thomas	Victoria
R. Bone	Victoria

This Board of Examiners consists of the Chief Inspector as Chairman and two other inspectors appointed by the Minister as members. Under the Mines Act, the Board conducts the examination of applicants for shiftboss certificates and certificates of competency, and issues those certificates for coal mines.

LEGISLATIVE CHANGES

The Exploration Regulation - Uranium and Thorium came into force following the lapse of the seven year provincial moratorium on uranium mining on February 28, 1987.

FATAL ACCIDENTS

A total of eight fatal accidents occurred during 1986-87: one in 1986 and seven in 1987. This average of four per year is down from the average 5.4 per year for the period 1981-1985, and 4.8 per year for the period 1976-80.

The accident in 1986 occurred on a road as a result of operations related to placer leases.

The locations of the accidents in 1987 were as follows:

Location of Fatal Accidents, 1987

location	no. of accidents	type of operation	accidents in 1981-85
Sullivan mine	2	underground and open pit metal	0
Afton	1	open pit metal	0
Westar Greenhills	1	open pit coal	2
Blackhams Construction	1	gravel pit	0

The two other accidents occurred off mine sites and were related to drilling and exploration activity.

DESCRIPTION OF FATAL ACCIDENTS

1986

1.
Name: Cecil Roy Petty Age: 37
Time: 24 October, 1986, approximately 10:30pm
Location: near Quesnel, B.C., on 3B road, off 300 road, off Hwy 26.

Petty was killed when the Michigan 175 loader that he was operating apparently ran away on a down-grade and left the road. Petty either fell or was thrown from the cab and was crushed under the left front wheel. The accident occurred on an industrial road while the equipment was being transferred from one placer lease to another. Even though the accident was not on a mine site it was felt to be mining related since the loader had been used on a placer lease for the previous two years.

Tests made on the loader following the accident showed that:
a) the breaking capacity was only 1-2% of normal;
b) there was no parking brake;
c) there was no emergency steering;
d) there was no roll-over protection;
e) the articulating joint was very badly worn; and
f) at speeds in excess of eight km/h the loader could not be controlled.

It was concluded that the machine was unfit for service.

After the inquest the Coroner made the following recommendations to the Ministry of Energy, Mines and Petroleum Resources:

> I recommend that a mining lease and the equipment to be used on site be checked by a mechanical inspector upon issuing the mining licence to the mining operator(s). I recommend that a miner indicate the equipment to be used on site when applying for a mining licence. To ensure safety protection to the operators of the equipment I suggest that the initial mechanical inspection be followed up by unscheduled on-site mechanical checks throughout the year.

In response to the Coroner's recommendations the Honourable Jack Davis, Minister of Energy, Mines and Petroleum Resources, instructed that a training program for non-mechanical inspectors be carried out so they can conduct basic safety checks on vehicles and other equipment on smaller operations.

1987

1.
Name: Graham D Bingham Age: 48
Time: 18 April, 1987, 10:57am
Location: 3770 level, Sullivan mine

Bingham was fatally injured as a result of being crushed between a scooptram and a 4x4 Toyota Jeep. The Jeep had been left on a 6.6% incline with the parking brake on, about three metres from the scooptram. The parking brake cable inside the left wheel drum apparently snapped, releasing the Jeep which rolled backwards down the incline and pinned Bingham against the scooptram.

It was concluded that "the primary cause of the accident was the failure of Mr. Bingham to follow correct parking procedures, i.e. positioning the vehicle touching a wall, applying the parking brake, switching off the motor and leaving the vehicle in first or reverse gear as appropriate." Testing done on the Jeep showed it to have been in reasonable mechanical condition.

The Coroner's recommendations were:

> I recommend that Cominco remind all of their employees in the Sullivan Mine who operate this type of vehicle of the importance of carrying out safe parking procedures.

Cominco was absolved of blame regarding the accident and had already issued safety reminders to its employees.

2.
Name: Mario Cupello Age: 30
Time: 24 June, 1987, 12:38pm
Location: Bench elevation 1460, Afton mine

Cupello was killed when he backed the haul truck he was operating over the berm at the edge of the bench at elevation 1460. The dozer operator who was acting as spotter had been called away at 12 noon. He had instructed Cupello and the other haul truck driver to dump short on the upper bench until he returned. At approximately 12:35pm Cupello started backing his truck toward the berm at the edge of the bench. For unknown reasons the truck accelerated in reverse toward the west end of the bench (a closed area), struck the berm, continued over the bank and rolled

towards the pit bottom. There was no evidence of braking action from tires on the ground. The seat belt had not been used and Cupello was found dead under the overturned truck.

It was concluded that Mr. Cupello may have been fatigued by the very hot weather, leading to poor judgement. Neither drugs nor alcohol were factors, and Cupello had many years of experience driving haul trucks. However, had he been wearing the seat belt it is likely he would have survived the accident since the truck cab suffered little damage.

The Coroner's recommendations were:

> 1. It is recommended that additional requirements should be considered whereby access to hazardous areas in proximity to an active dump site be suitably barricaded.
> 2. It is also recommended that the compulsory use of seat belts by mine vehicle operators should be considered as an important safety requirement.

A committee has been set up to review and revise regulations and equipment to improve safety for haul truck drivers.

3.
Name: Dean Phillip Moret Age: 24
Time: 24 June, 1987, approximately 8:45pm
Location: Tommy Jack Mountain, 100 miles east of Stewart, B.C.

Moret was killed as a result of mauling and decapitation by a black bear. Moret had been set down by helicopter to work alone running a water line between drill sites. The attack was not discovered until 10:00pm when the night shift arrived and found the remains. They encountered the bear and hastened back to camp to report the incident and get weapons. The bear, which was found to have been healthy and fit, was located and killed the next morning. The only discernable reason for the attack was the attractive smell of supper cooking at the camp. It is possible, because of the remote location, that the bear had not seen a human before.

It was concluded that "persons exposed to these risks should be aware of precautions to be taken to prevent possible bear attacks. Contractors should be given specific instructions on camp selection, maintenance and cleanliness. ...Each camp where humans are present should have access to a firearm to be used as a last resort. ...It is unfortunate that Dean did not have any means of warning others in the camp or calling for assistance when he first encountered the bear."

The Coroner's recommendation was:

> I recommend the Ministry of Energy, Mines and Petroleum Resources encourage employers to provide some manner of communication for employees that are required to work in the wilderness in similar circumstances to those in which Dean Moret was employed.

In response to the Coroner's recommendation the Minister of Energy, Mines and Petroleum Resources advised that Energy, Mines and Petroleum Resources staff will require employers to provide effective communication to employees. In addition, employers are also to be advised of the various publications which deal with precautions against bear attacks.

4.
Name: David (Charlie) Melvin Nohels Age: 45
Time: 9 August, 1987, 8:45pm
Location: Mine tailings dam, Westar's Greenhills mine

Nohels drowned when the compactor he was operating drove off the tailings dam into the adjacent pond. Nohels' behavior before the accident was consistent with the later finding of a 0.08% blood alcohol level. Mr. Kibala noticed that Nohels was missing at 8:30pm, and saw tracks running down the slope towards the water. Later observations showed that the compactor had apparently been going round in circles on the dyke before straightening out and running directly into the pond. The body was retrieved from the pond by RCMP divers on their first dive at 11:09pm.

It was concluded that the deceased had consumed alcohol on the mine site and had behaved in a strange manner prior to the accident. The Coroner's report showed a blood alcohol level of 0.08%, the level at which a person is considered intoxicated for driving on public roads. A verdict of "accidental death" has been entered, with alcohol as a contributing factor.

The Coroner made no recommendations.

The mine has reviewed its procedures relating to the supervision of contractor's employees to ensure better supervision and control.

5.
Name: Marcel Augusto Taft Soux Age:17
Time: 12 August, 1987, 1:00pm
Location: Shakti Mineral Property, Shangra-La Minerals Ltd., north face of Mount George, 36 miles south of Stewart, B.C.

Soux was killed when he fell over a cliff while working on a grid line on the north side of Mount George. Soux was marking the grid line with red flagging and a hip chain. Raphael Diaz, who was working behind Soux as his partner, realized as he followed the hip chain that it had been cut and extended over the cliff. Raphael located Soux and then went back to camp for medical supplies and help; however, when they reached Soux they found that the trauma was severe and death was certain.

The investigation found that:
a) Soux was only 17 years old and had no experience working on rock ledges;
b) Soux was wearing inappropriate logger "cork" boots at the time of the accident;
c) Soux had a "cavalier" attitude (according to one of his superiors), and had ventured well beyond the area where he was instructed to set out the grid line; and
d) death was accidental and a result of Soux's own misadventure.

No recommendations were made as a result of this accident and the Coroner did not order an inquiry or an inquest.

6.
Name: Lloyd J. Chabot Age: 45
Time: 23 November, 1987, approximately 6:00pm
Location: 3290 Level, Scram #2, 603 Block, Sullivan mine

Chabot died as a result of the multiple injuries he received when he was struck by a fall of ground from the sidewall of the drift. Chabot and his partner, Romeo Denis, had completed preparations

for drilling the next development round the scram. After returning from an absence of 80 minutes, Denis found Chabot pinned under rock which had sloughed from the drift wall. Chabot died from the injuries while he was being transported to hospital.

An investigation revealed that the angle at which the drift was being driven, in relation to the strike of the ore body and the strike of two bedding planes and joints, was of paramount importance. These intersecting structural planes of weakness had released a large block of rock which had pinned Chabot.

It was concluded that a procedure is required to systematically support the side walls (as well as the back) of all drifts oriented along the strike of an ore body. Such a procedure would involve a pattern of rock bolting along the side walls following each round, and application of shotcrete within 20 feet of the face. This procedure was subsequently introduced at Sullivan mine.

The Coroner's recommendations were that the Ministry of Energy, Mines and Petroleum Resources have Inspectors with the background and experience to see the "big picture" make more frequent inspections of all parts of Sullivan mine. In addition, recommendations were that Sullivan mine:
a) review barring procedures plus steel strapping to be used for rock bolting on the side walls where bolts in deep slabs may not be effective;
b) have more thorough washing of the side walls to make the ground structure and potential problems easier to check; and
c) improve communication between supervisors, engineers and geology staff.

7.
Name: David Otto Ferenczi Age: 18
Time: 3 December, 1987, approximately 8:10pm
Location: The crushing plant, Blackham Gravel Pit, Matsqui municipality.

Ferenczi died of strangulation when the front of his clothes became entangled in the main tail-pulley drive shaft of a conveyor. That evening, Ferenczi was responsible for operating the gravel crushing plant. At approximately 7:55pm Mr. Edward Albright, who was in charge of activities at the Blackham pit that night, had instructed Ferenczi to close down the gravel crushing plant for the night, then grease up the loader he was operating, before finishing his shift. At about 8:30pm, Mr. Albright went to the gravel crushing plant and found it still running. Ferenczi was found lifeless in a kneeling position on the ground at the off side of the conveyor tail pulley. His right arm was extended through the framework of the conveyor, while his chest was pulled up tightly against the end of the conveyor pulley shaft.

It appeared that Ferenczi had reached through the framework with his right hand, presumably to remove some unwanted material, and had misjudged the danger of the slowly revolving shaft. His clothing at chest level became entangled in the extruding end of the shaft and were quickly pulled tight around his chest and neck, forcing the air to be expelled from his body. The death was found to be accidental.

After an intensive investigation, Ministry of Energy, Mines and Petroleum Resources' investigators made specific recommendations which were implemented voluntarily by Blackham Gravel Ltd. prior to putting the plant back in operation. Guards were placed over all exposed moving shafts and pulleys to prevent a similar accident.

ACCIDENTS CAUSING DEATH OR INJURY

The following tables classify the accidents causing death or injury that were reported to the Branch by cause, occupation and parts of the body injured.

Accidents causing death or injury by cause

cause	1986		1987	
	no.	%*	no.	%*
atmosphere	3	0.89	1	0.41
explosives	1	0.30	1	0.41
falls of ground	10	2.98	9	3.67
falls of persons	83	24.70	60	24.49
lifting and handling material	53	15.77	37	15.10
machinery and tools	31	9.23	34	13.88
transportation	11	3.27	27	11.02
miscellaneous	144	42.86	76	31.02
totals	336	100.00	245	100.00

* per cent of total accidents

Accidents causing death or injury by occupation of those injured

occupation	1986		1987	
	no.	%*	no.	%*
underground				
chutemen	4	1.19	0	0
haulagemen	15	4.46	8	3.27
miners	27	8.04	36	14.69
helpers	5	1.49	2	0.82
timbermen and facemen	5	1.49	2	0.82
mechanics (electricians, supplymen, welders, etc.)	18	5.36	9	3.67
miscellaneous	13	3.87	8	3.27
surface				
mechanics, electricians repairmen	94	27.98	69	28.16
mill and crusher workers	19	5.65	15	6.11
carpenters	10	2.98	2	0.82
labourers, surveyors, construction, etc.	0	0	0	0
miners, drillers	5	1.49	12	4.90
vehicle drivers	54	16.07	52	21.22
miscellaneous	67	19.94	30	12.25
totals	336	100.00	245	100.00

* per cent of total accidents

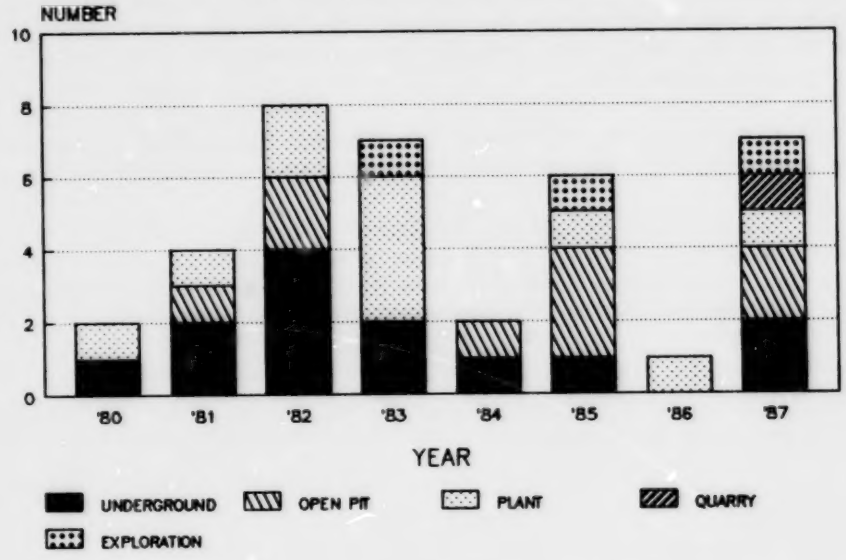
Accidents causing death or injury by parts of the body

part of the body	1986		1987	
	no.	%*	no.	%*
eyes	14	4.01	13	4.52
head, face, neck	21	8.31	28	9.72
trunk	115	32.95	120	41.67
upper extremities	59	16.91	42	14.58
lower extremities	90	25.79	71	24.65
general	42	12.03	14	4.86
totals	341**	100.00	288**	100.00

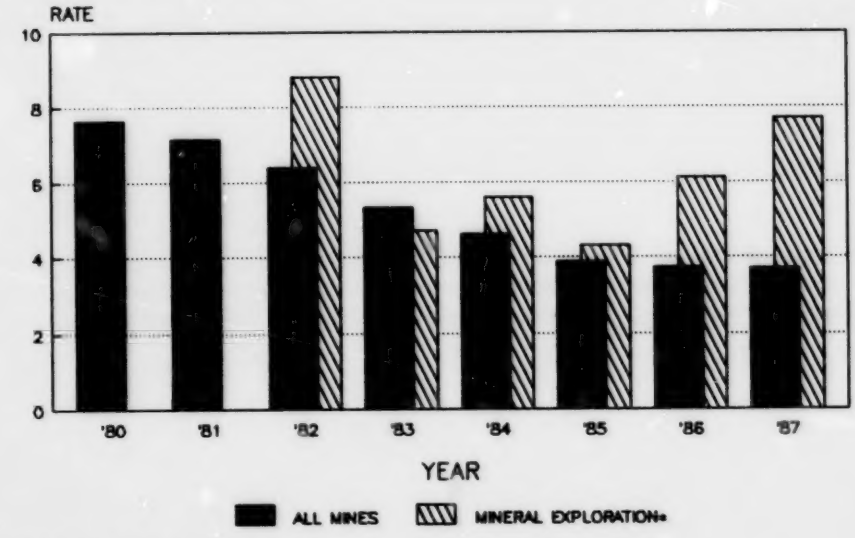
* per cent of total accidents
** total number of times each part of the body was injured. More than one part of the body may be injured in each accident, so total number greater than shown on previous two tables.

The following graph shows the accident frequency rates for activity in B.C. mines, and for exploration activity, per 200,000 manhours worked.

B.C. MINING FATALITIES
1980 – 1987



B.C. ACCIDENT FREQUENCY RATES
PER 200,000 MANHOURS



*Exploration data N/A for 1980, 1981.

DANGEROUS AND/OR UNUSUAL OCCURRENCES

Section 13 of the Mines Act requires that all dangerous and/or unusual occurrences at any mining operation be reported to the Inspector of Mines within 24 hours of their happening, whether an actual injury occurred or not. It is established that the detailed study of such occurrences, and the dissemination of information about the causes, can help to reduce future accidents. Consequently, the Engineering and Inspection Branch attempts to study and distribute the information as widely as possible.

The statistics concerning these occurrences are tabulated below for the 1986-1987 period. Condensed summaries of all occurrences are compiled and issued periodically by the Branch.

Dangerous and/or unusual occurrences by nature of occurrence

	1986		1987	
nature of occurrence	surface	u/g*	surface	u/g*
vehicle and mobile equipment operation	13	1	32	3
fires	-	-	5	-
explosives handling and use	4	1	4	-
caught in machinery	-	-	1	-
electrical failure or misuses	-	-	2	-
equipment failure or misuses	-	3	8	1
falls of ground	1	1	2	1
falls of persons	-	-	-	2
mishandling of chemical substances	2	1	1	-
drilling	-	-	1	-
miscellaneous	1	-	3	1
total	21	7	59	8

* u/g = underground

PROSECUTIONS

1986

Charges were laid against Quintette Coal Ltd. under the following sections of the Coal Mines Regulation, Mines Act:

1. Section 230
2. Section 231 (1) (b)
3. Section 237 (1) (a)
4. Section 237 (1) (b).

The charges were laid after an extensive investigation and inquest into an incident on April 12, 1985, when a 154 tonne haulage truck was reversed over the edge of a roadway being built downgrade in the Frame Pit at Quintette Coal mine. The truck rolled approximately 45 metres down the dump face. The two occupants were thrown from the cab and received fatal injuries.

The trial held at Dawson Creek, B.C. on February 17, 18 and 19, 1986, acquitted Quintette Coal Ltd. of all charges. An appeal heard before the County Court at Dawson Creek on December 9, 1986, upheld the Provincial Court decision of not guilty.

1987

No prosecutions.

BLASTING CERTIFICATE SUSPENSIONS

1986

There were no blasting certificate suspensions in 1986.

1987

Three blasting certificates were suspended as a result of the same incident on August 9, 1987 at Quintette Coal Mine.

The certificates of Messrs. Hartmut Bluschke, Ernst Rosger and Randy Forrest were suspended after a breakdown in communications led to a blast being initiated whilst an employee was tying the cap, out of sight of the blaster. This incident violated Section 43, Coal Mines Regulation, Mines Act.

MECHANICAL-ELECTRICAL

1986

Most of the work undertaken by this Section continued to consist of on-site inspections, and the qualification of new pieces of equipment prior to their use at mines.

Concern arose over reports that the United States may phase out production of those brake linings which contain asbestos and are used on large vehicles. Finding a substitute for asbestos may prove problematic, especially when such linings are subjected to high speed testing.

A thorough investigation was conducted into the manufacturing of wheel parts for large haulage trucks in the Province. This has resulted in the local manufacture and repair of such components with stringent quality-control conditions.

Discussions involving a protocol agreement with the Ministry of Transportation and Highways were initiated, with a view to facilitating the approval and regulation of railways at mines.

Preliminary work was begun on reviewing the mechanical and electrical content of the Mines Regulation and Coal Mines Regulation. An industry/union subcommittee will be established and charged with this task in the future.

1987

The review of modified or new pieces of equipment, together with on-site inspections, were again the items of work demanding most of the Section's resources.

Earlier reports regarding the phasing out of production of asbestos-containing brake linings in the United States were substantiated. This has caused concern at most mines in the Province. Several meetings were held with suppliers of both linings and large haulage trucks in an effort to impress upon them the need for an uninterrupted supply of brake linings that can meet the current braking criteria. Substantial effort has been expended on producing a non-asbestos based lining. Several field tests, held during the latter part of the year to evaluate the performance of some newly introduced linings, were successful.

The Section organized a Mechanical-Electrical Symposium during February which was well attended by various representatives from the mining industry. These symposia are now held biennially.

The computerization of the Section's records was commenced. A database was created to store information pertaining to the brake testing of haulage trucks larger than 45 tonnes.

The staff of the Section remains involved in the production of several Canadian Standards relating to mining activities. These include the use of electricity in mines, underground trackless equipment and fire resistant fluids.

Synopsis of Major Mechanical Surface Equipment in Use at Mines in British Columbia during 1986

Haulage Trucks

Type of Operation	Capacity (tonnes) 0-19	20-39	40-74	75-99	100-149	150-174	175-199	200+	Total
Coal Mines	4	17	16	46	55	69	68	5	280
Metal Mines	24	24	22	56	64	0	0	11	201
Others	135	49	5	0	0	0	0	0	189
Totals	163	90	43	102	119	69	68	16	670

Front-End Loaders

Type of Operation	Bucket Size (m3) 0-1.9	2.0-3.9	4.0-5.9	6.0-8.9	9.0-11.9	12.0-14.9	15.0-19.9	20.0+	Total
Coal Mines	6	6	10	5	22	5	6	2	62
Metal Mines	25	25	12	2	3	0	1	1	69
Others	54	83	25	5	5	0	0	0	172
Totals	85	114	47	12	30	5	7	3	303

Shovels

Type of Operation	Shovel size (m3) 0-1.9	2-3.9	4-5.9	6-7.9	8-9.9	10-11.9	12-14.9	15-19.9	20.0+	Total
Coal Mines	1	2	6	0	2	6	20	4	11	52
Metal Mines	2	3	2	1	15	8	0	2	0	33
Others	19	3	0	0	0	0	0	0	0	22
Totals	22	8	8	1	17	14	20	6	11	107

Rotary Drills

Type of Operation	Drill Diameter (mm) 0-79	80-159	160-204	205-254	255-299	300+	Total
Coal Mines	3	5	0	3	10	23	44
Metal Mines	9	1	1	12	0	7	30
Others	1	0	0	0	0	0	1
Totals	13	6	1	15	10	30	75

Mobile Cranes

Type of Operation	Lifting Capacity (tonnes) 0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
Coal Mines	8	5	1	3	2	2	2	1	1	25
Metal Mines	3	8	3	4	4	0	0	0	1	23
Others	0	0	0	1	0	0	0	0	0	1
Totals	11	13	4	8	6	2	2	1	2	49

Other Equipment Over 5000 kg Mass

Type of Operation	Dozers	Graders	Scrapers	Other*	Total
Coal Mines	120	35	13	69	237
Metal Mines	59	26	5	96	186
Others	41	9	2	33	85
Totals	220	70	20	198	508

*Includes service vehicles, backhoes, sand and water trucks, compactors, lift trucks, portable compressors, generators, screening plants, draglines, etc.

Synopsis of Major Mechanical Underground Equipment in Use at Mines in British Columbia during 1986

Diesel Powered Equipment

Load-haul-dump	22
Front-end Loaders	0
Haul Trucks	10
Locomotives	0
Drill Jumbos	17
Graders	5
Dozers	0
Others	112
Total	166

Hoists in Use

Sullivan	2
Westmin	4
Mosquito Creek	1
Parson Barite	1
Dentonia	1
Total	9

Synopsis of Major Mechanical Surface Equipment in Use at Mines in British Columbia During 1987

Haulage Trucks

Type of Operation	Capacity (tonnes) 0-19	20-39	40-74	75-99	100-149	150-174	175-199	200+	Total
Coal Mines	5	3	17	34	57	119	22	1	258
Metal Mines	20	23	5	86	49	43	0	11	237
Others	181	54	7	6	0	0	0	0	248
Totals	206	80	29	126	106	162	22	12	743

Front-End Loaders

Type of Operation	Bucket Size (m3) 0-1.9	2.0-3.9	4.0-5.9	6.0-8.9	9.0-11.9	12.0-14.9	15.0-19.9	20.0+	Total
Coal Mines	3	5	8	4	23	5	6	2	56
Metal Mines	31	25	8	4	9	0	0	2	79
Others	50	122	67	8	6	0	0	0	253
Totals	84	152	83	16	38	5	6	4	388

Shovels

Type of Operation	Shovel size (m3) 0-1.9	2-3.9	4-5.9	6-7.9	8-9.9	10-11.9	12-14.9	15-19.9	20.0+	Total
Coal Mines	0	1	0	0	0	2	28	5	11	47
Metal Mines	0	0	3	5	17	10	0	6	0	41
Others	17	4	0	0	10	0	0	0	0	21
Totals	17	5	3	5	17	12	28	11	11	109

Rotary Drills

Type of Operation	Drill Diameter (mm) 0-79	80-159	160-204	205-254	255-299	300+	Total
Coal Mines	3	2	1	2	10	24	42
Metal Mines	2	1	5	17	4	3	32
Others	8	8	0	0	0	0	16
Totals	13	11	6	19	14	27	90

Mobile Cranes

Type of Operation	Lifting Capacity (tonnes) 0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80+	Total
Coal Mines	8	1	0	4	1	2	1	1	1	19
Metal Mines	4	10	2	6	5	0	1	0	2	30
Others	1	0	2	1	1	0	0	0	0	5
Totals	13	11	4	11	7	2	2	1	3	54

Other Equipment Over 5000 kg Mass

Type of Operation	Dozers	Graders	Scrapers	Other*	Total
Coal Mines	100	27	10	46	183
Metal Mines	62	31	4	71	168
Others	56	15	0	59	130
Totals	218	73	14	176	481

*Includes service vehicles, backhoes, sand and water trucks, compactors, lift trucks, portable compressors, generators, screening plants, draglines, etc.

Synopsis of Major Mechanical Underground Equipment in Use at Mines in British Columbia during 1987

Diesel Powered Equipment

Load-haul-dump	62
Front-end Loaders	2
Haul Trucks	12
Locomotives	10
Drill Jumbos	23
Graders	5
Dozers	0
Others	86
Total	200

Hoists in Use

Sullivan	2
Westmin	4
Bralorne	1
Parson Barite	1
Equity	1
Dentonia	1
Total	10

ELECTRICAL STATISTICS

Metalliferous Mines

Reported power generated at company owned generating plants totalled:

1986	94,275,644 KWH
1987	92,927,750 KWH

Reported power purchased from public utilities totalled:

1986	2,244,172,253 KWH
1987	2,580,149,754 KWH

Total power consumption:

1986	2,338,447,897 KWH
1987	2,673,077,504 KWH

The following table provides an analysis of connected load at operating metalliferous mines.

Connected Load at Metal Mines

equipment	rated power (KW) 1986	1987
trams and hoists	1,529	3,039
scraper hoists	5,031	5,031
electric shovels	21,774	26,399
electric drills	5,806	5,821
fans	11,912	12,322
pumps	7,580	7,778
rectifiers	4,250	4,550
M.G. sets	2,336	2,254
air compressors	16,080	15,275
sink and float	5,147	7,274
crushing	19,151	37,529
grinding	145,502	214,068
concentrating	40,151	39,393
magnetic separation	41	49
conveyors	18,511	20,171
mill pumps	34,204	37,748
fresh water pumps	21,746	29,284
workshops	6,026	7,289
miscellaneous	22,052	31,827
total	388,829	507,101

Structural Material and Industrial Minerals

Reported power generated at company owned generating plants totalled:

1986	41,952,282 KWH
1987	47,392,095 KWH

Reported power purchased from public utilities totalled:

1986	9,143,430 KWH
1987	20,154,011 KWH

Total power consumption:

1986	51,095,712 KWH*
1987	67,546,106 KWH

* Due to the poor response to the request for statistics, the result is not considered accurate or representative of the activity in the mining of aggregates.

The following table provides an analysis of reported connected load at operating structural material and industrial mineral mines, including sand and gravel pits.

Connected Load at Structural Material and Industrial Mineral Mines

equipment	rated power (KW) 1986*	1987
trams and hoists	448	480
fans	172	470
pumps	172	625
MG sets	224	224
compressors	457	468
shovels	448	448
drills	489	491
drying plants	914	1,667
crushing	3,540	10,263
conveyors	12,023	19,794
milling	2674	2,894
screens	339	2,279
pumps	521	1,797
workshops	369	633
miscellaneous	3,879	4,780
total	26,669	47,313

* Due to the poor response to the request for statistics in this year, the figures are not considered accurate or representative of the true totals.

Coal Mines

Reported power purchased from public utilities totalled:

1986	581,837,500 KWH
1987	612,280,346 KWH

The following table provides an analysis of connected load at operating coal mines.

Connected Load at Coal Mines

equipment	rated power (KW) 1986	1987
draglines	6,490	6,490
ventilation and drying	3,230	3,599
electric shovels	40,254	40,254
electric drills	13,692	13,692
conveyors	11,324	10,261
hoisting	308	166
haulage	0	0
coal breaker	2,129	2,410
washing and screening	45,069	48,855
pumping	24,048	24,048
air compressors	2,942	4,032
miscellaneous	43,326	43,349
total	192,812	197,156

The following table provides a summary of power consumption at all types of operations since 1975.

Actual Consumption of Power (million kilowatt hours)

year	metal mines	industrial minerals	coal mines	total
1975	2,092.1	66.8	363.3	2,522.2
1976	2,125.7	80.9	211.2	2,417.8
1977	2,212.1	78.7	312.0	2,602.8
1978	2,057.9	67.9	289.2	2,415.1
1979	2,257.4	88.8	299.8	2,646.0
1980	2,359.3	95.1	277.9	2,732.3
1981	2,761.6	65.3	319.6	3,146.5
1982	2,605.5	77.5	330.4	3,013.4
1983	2,434.1	76.9	356.6	2,867.6
1984	1,975.0	91.2	578.4	2,644.6
1985	2,255.3	69.8	634.9	2,960.0
1986	2,338.4	51.1	581.8	2,971.3
1987	2,673.1	67.5	612.3	3,352.9

ENVIRONMENTAL CONTROL

The Ministry of Energy, Mines and Petroleum Resources' environmental control inspectors conduct inspection surveys for dust, asbestos fibre, ventilation, radon daughters, gases and noise at metal, coal and industrial minerals mines and quarries throughout the Province of British Columbia.

Measurements of the ventilation, and observations of the condition of dust-control systems and other measures relative to the prevention, suppression and elimination of dust and health hazards are conducted on a regular basis. Subsequently, recommendations and advice are given for improvements to assist in lowering the health hazard in general.

In 1986 and 1987, personal gravimetric samplers were used for sampling the rock dust at mining operations; the filters were analyzed for the mass of free silica present using the infra-red method. At coal operations, personal gravimetric sampling was used to determine the mass of respirable coal dust per unit volume of air. In maintenance shops, welding fumes were determined using personal gravimetric sampling; the filters were weighed to determine the mass of metal fume per unit volume of air. At the only asbestos mine in the Province, the membrane filter method was used to measure the number of asbestos fibres per unit volume of air.

The Environmental Control Inspector of Mines (audiologist) is responsible for training, examining and certifying audiometric technicians for the mining industry. The audiologist also implements and monitors hearing conservation programs at mines to ensure compliance with the Mines Act.

Noise exposure surveys are performed. Types of sampling include personal audiometry, area averages, and detailed octave band analysis. The accuracy of the hearing test equipment is verified at companies which have such equipment.

1986

During the year, 33 surveys were made of the environmental conditions at 30 mining operations including underground metal mines; open-pit metal, coal and asbestos mines; sand and gravel pits; and at crushing plants, concentrators and assay grinding rooms.

Seventy-five audiometric technicians attended 15 courses, and 54 noise exposure surveys were performed.

An Industrial Hygiene Symposium, organized by the Section, was held on March 20 and 21, 1986.

A protocol agreement, relating to the transport of dangerous goods on mine sites, was drawn up and signed by the Chief Inspector of Mines and the Dangerous Goods Co-coordinator, Motor Vehicle Department, Ministry of Transportation and Highways.

1987

During the year, 54 surveys were made of the environmental conditions at mining operations including underground metal mines; open-pit metal, coal and asbestos mines; sand and gravel pits; and at crushing plants, concentrators and assay grinding rooms.

Fifteen surveys were made at non-uranium underground mines for alpha and gamma radiation.

Sixty-seven people participated in Industrial Audiometry courses taught by the audiologist at six training courses and 16 refresher courses.

Forty-five noise exposure surveys were performed at mines.

An Industrial Hygiene Symposium, organized by the Section, was held from February 25-27, 1987.

In October, 1987, the Section was put on the mailing list for CINFO discs, information circulars, safety infograms, and chemical infograms from the Canadian Centre for Occupational Safety and Health.

The following tables show details of the audiometric and dust control programs during 1986-1987.

Audiometric Training/Sound Survey Statistics

	1986	1987
Audiometric technicians		
- number trained	32	27
- certificate renewal	43	40
Sound surveys		
- number conducted	54	45
- number of operations	54	45
Results:		
- workers wearing ear protection where required	90%[1]	90%[1]
- drill mufflers in use	100%[1]	100%[1]
- properties performing audiometric tests on workers	100%[2]	100%[2]

[1] approximate
[2] with the exception of a few small gravel pits

Dust Control Inspections

Type of Inspection	1986	1987
Metal, Coal, Asbestos, Uranium, Limestone and Rock Quarries:		
- number of inspections	26	65
- number of operations	23	50
Percent meeting standards:		
Underground mines		
- drilling	90*	90*
- other u/g operations	95*	95*
- crushing plants	75*	75*
- assay grinding rooms	100	100
Open Pit Mines		
- drilling	100	100
- other operations	100	100
- crushing plants	75*	75*
Structural and Industrial Minerals:		
- number of inspections	7	4
- number of operations	7	4
Percent meeting standards:		
- drilling	100	100
- crushing and screening	100	100

* approximate

SHIFTBOSS CERTIFICATES

Section 24 of the Mines Act requires that every person employed underground or in open pit workings must be under the daily supervision of an official who is the holder of a shiftboss certificate issued under the Act. In addition, section 32 of the Mines Act specifies that every person employed in open pit workings at a coal mine be under the daily supervision of a shiftboss or other official who is the holder of an open pit shiftboss certificate issued under the Act.

An applicant for a shiftboss certificate must hold a non-restricted blasting certificate (gravel pits excluded), a mine rescue certificate (surface or underground as requisite), and a currently valid first-aid certificate. The applicant must also pass an examination on the rules and regulations contained in the respective Acts.

Four different certificates are issued: one for underground metal mining operations; one for open pit coal mining operations; one for open pit metal mining operations; and one for sand-, gravel- and clay-removal operations. A fee of $50 is charged for the examination and the passing grade is 65%. When it considers it advisable, the Board of Examiners may also grant provisional certificates on a one-time basis for a period of six months.

The following tables show the certifications for 1986-1987.

Total Shiftboss Certification Activity

	1986	1987
applications received	n/a*	91
examinations written	33	50
number passed	31	50
number of certificates issued	59	77

* not recorded at that time

Shiftboss Certificates Issued by Type

type	1986	1987
underground metal	19	29*
open pit coal	19	18
open pit metal	19	24
gravel pits	2	6
provisional	33	44

*1987 - 8 underground crushing and conveying, Sullivan mine.

CERTIFICATES OF COMPETENCY

Sections 32, 33 and 34 of the Mines Act require that managers and certain other supervisory officials at underground and open pit coal mines shall be holders of certificates of competency issued under this Act. The Board of Examiners, appointed by the Minister, is responsible for setting examinations for these certificates from time-to-time, for considering applications, for interchange certificates, and for issuing certificates.

Certificates are issued in accordance with section 35 of the Act. The certificates and corresponding fees are as follows:

First Class Certificate of Competency-Underground $100.00
Second Class Certificate of Competency-Underground ..... $ 75.00
Third Class Certificate of Competency-Underground ..... $ 50.00
Mine Surveyor Certificate $100.00

There were no certificates of competency issued in 1986.

Four certificates of competency were issued in 1987:

- one first class certificate
- one second class certificate
- two third class certificates.

MINE SURVEYOR CERTIFICATES

There were no mine surveyor certificates issued in 1986 or 1987.

MINE RESCUE, SAFETY AND FIRST-AID

The promotion of mine rescue, safety and first aid, and the provision of assistance to the industry, are key functions of the Engineering and Inspection Branch.

Six district mine rescue stations were fully maintained, one in each of the districts of Fernie, Nelson, Kamloops, Nanaimo, Prince George and Smithers. The stations are under the supervision of coordinators who are fully qualified in all aspects of first-aid and mine rescue. Each station is established as a mobile unit to transport equipment to anywhere in the area. They are available for either rescue or training services, and carry sufficient self-contained breathing equipment to maintain at least two six-man rescue teams.

The mine rescue equipment owned by the Ministry of Energy, Mines and Petroleum Resources is: 59 Aerorlox; three hour liquid oxygen breathing apparatus; 43 Draeger B.G.174; 20 (30 minute) pressure/demand Airpak units; and 29 Chemox chemically produced oxygen units. The equipment owned by industry is: 18 Aerorlox; 70 Draeger B.G.174, 125 (30 minute) Airpak units; and 59 Chemox units. Each station, and most mines, also have auxiliary equipment such as Type N gas masks, self-rescuers, gas detectors, oxygen therapy units and first-aid equipment.

The district coordinators of rescue training make regular visits to the mines. They give rescue training to open pit and underground employees, and check the rescue equipment to ensure its serviceability. Both full and refresher courses in survival, underground mine, surface mine and gravel pit rescue training, as well as first-aid courses, are presented regularly by the district coordinators at various mines and centres throughout the Province.

The following table shows the mine rescue certificates issued in 1986 and 1987.

Mine Rescue Certifications

type of certificate	1986	1987
mine rescue survival instructor	-	1
mine rescue survival	40	45
underground mine rescue	76	36
surface mine rescue instructor	6	2
surface mine rescue	175	252
gravel pit rescue	30	5
advanced mine rescue	13	42
safety oriented first-aid	-	10
total	340	393

Five mine safety associations, sponsored by the Ministry of Energy, Mines and Petroleum Resources and the Workers' Compensation Board, continued to operate in different areas of the Province. These associations are:

1. the Vancouver Island Mine and Industrial Safety Association;
2. the East Kootenay Mine and Industrial Safety Association;
3. the West Kootenay Mine and Industrial Safety Association:
4. the South/Central B.C. Mine Safety Association; and
5. the North B.C. Mine Safety Association.

The associations consist of representatives from industry, the Engineering and Inspection Branch, the Workers' Compensation Board and St. John's Ambulance. Each association promotes mine rescue training, first-aid training and safety education in their respective district.

COMPETITIONS

Interest in mine safety and rescue work is stimulated by the various competitions held annually between mines in the Province and across the country. These competitions are in five categories.

1. Mine Rescue - Underground and Surface.
2. Underground Bench Competition.
3. Safety Competitions based on annual accident frequencies for small mines, and for open pit mines and quarries.
4. First-aid Competitions.
5. John T. Ryan Trophies, open to all Canadian mines, with one division for metal mines and one for coal mines. These trophies, which are awarded annually on both a regional and Canada-wide basis, are based on accident frequency results.

1. Mine Rescue - Underground and Surface

Each of the five mine safety associations sponsors annual competitions for underground and surface rescue. Winners from each district compete for the Provincial championship in their event. The winner of the underground competition goes on to compete in the Canadian championship; however, there is no Canadian surface mine competition.

Underground

In both 1986 and 1987 only three teams entered the underground competitions, therefore they competed directly in the Provincial competition. These teams were: Westmin Resources Ltd. (Western Mines) from the Vancouver Island Mine and Industrial Safety Association; Cominco Ltd. (Sullivan Mine) from the West Kootenay Mine and Industrial Safety Association; and Blackdome Mining Corp. from the South/Central B.C. Mine Safety Association.

The winner of the Provincial Underground Mine Rescue Competition was Westmin Resources Ltd. in 1986 and Blackdome Mining Corp. in 1987.

In 1986, the 18th Canadian National Underground Mine Rescue Competition was hosted by B.C. It was held in Nanaimo on September 19th and 20th. Seven teams competed from Nova Scotia, Yukon, Ontario, Saskatchewan, British Columbia, Alberta and the Northwest Territories. The competition included the following sections: written, bench and gas, fire fighting, smoke, obstacle and recovery, and first-aid. The winners are shown in the table below.

18th Canadian National Underground Mine Rescue Competition

task	winning team	trophy
written	Yukon (Keno Hill mine)	M.S.A. Canada Trophy
bench & gas	Team Ontario	Safety Supply Trophy
fire fighting	B.C.(Westmin Res. Ltd.)	Levitt Safety Trophy
smoke	Team Alberta	Safety Supply Trophy
obstacle & recovery	N.W.T(Nanisivik mines)	United Mine Workers Trophy
first-aid	Team Ontario	United Steel Workers Trophy

The overall winners were Team Ontario and N.W.T. Nanisivik mines. The two teams will time-share the British Columbia Mining Association Trophy.

The 1987 Canadian Competition was to have been held in Saskatchewan; however, that province withdrew and the competition was not held in 1987.

Surface

Surface competitions were held by the following safety associations: East Kootenay, South/Central, and North. In 1986 and 1987 both the first and second place teams went on to compete in the Provincial competition. The winners were as follows.

East Kootenay Mine and Industrial Safety Association:

1986 - Westar Mining (Balmer) and Byron Creek Collieries
1987 - Westar Mining (Greenhills) and Fording Coal Ltd.

South/Central B.C. Mine Safety Association:

1986 - Utah Mines and Highland Valley Copper
1987 - Afton Mines and Highland Valley Copper

North B.C. Mine Safety Association:

1986 - Gibraltar Mines Ltd. and Quintette Coal Ltd.
1987 - Bullmoose Operating Corp. and Equity Silver Mines Ltd.

The Provincial Surface Mine Rescue Competition was won by Highland Valley Copper in both 1986 and 1987.

2. Underground Bench Competition

The Provincial Underground Bench Competition was instituted in 1978. Competing teams must demonstrate their proficiency in the examination and testing of their apparatus prior to use. The event is in memory of the late B. Abbott, captain of the Cominco Ltd. H.B. mine rescue team in 1976 which won the Canadian Mine Rescue Competition that year.

This competition was won by Westmin Resources Ltd. in both 1986 and 1987.

3. Safety Competitions

Small Mines

In 1951 the West Kootenay Mine Safety Association donated a safety trophy for annual competition to encourage and promote safety in small mines. Entrants were originally restricted to mines in the West Kootenay area, but since 1956 entries have been accepted from qualifying mines throughout the Province. The award is given to the metal mine that has the lowest compensable accident rate after working from 2,500 to 30,000 shifts per year, at least one third of which were underground.

1986 winner: Taurus Gold
1987 winner: Nugget Mine

Open Pit Mines and Quarries

Trophies are awarded by the Ministry of Energy Mines and Petroleum Resources to those operations having the lowest compensable injury-frequency rate.

1. The "A" trophy goes to operations having from 35,000 to 200,000 man-hours per year.

2. Up to 1987, the "B" trophy went to operations having more than 200,000 man-hours per year. Since the introduction of the "C" trophy in 1987, the "B" trophy goes to operations having from 200,000 to 1,000,000 man-hours in the year.

3. The "C" trophy, introduced in 1987, goes to operations that worked a minimum of 1,000,000 man-hours during the year.

In addition, since 1977 Certificates of Achievement have been awarded to operations amassing 15,000 man-hours without accidents over a continuous period not previously used to obtain an award.

1986

1986 "A" Trophy winners:
- Ash Grove Cement West Inc. (Blubber Bay Quarry, Texada Island)
- Baymag Mines Ltd.
- Placer Development Ltd. (Endako Mine)
- Westroc Industries Ltd., (Windermere operations)

1986 "B" Trophy winner:
- Equity Silver Mines Ltd. (Houston)

1986 Certificate of Achievement winners:
- Bay Concrete (Qualicum Beach Gravel Pit)
- Blackham Construction (Abbortsford Gravel Pit)
- Canada Cement Lafarge (Vananda Quarry, Texada Island)
- Jack Cewe Ltd. (Treat Creek, Jervis Inlet Gravel Pit)
- Goodbrand Ready Mix & Aggregates (Matsqui Gravel Pit)

1987

1987 "A" Trophy winners:

- Ash Grove Cement West Inc. (Blubber Bay Quarry, Texada Island)
- Baymag Mines Ltd. (Radium)
- Westroc Industries Ltd. (Windermere operations)

1987 "B" Trophy winner:

- Equity Silver Mines Ltd. (Houston)

1987 "C" Trophy winner:

- Quintette Coal Ltd. (Tumbler Ridge)

1987 Certificate of Achievement winners:

- Allard Contractors (Albion Pit, Haney)
- Carr Sand and Gravel (Albion)
- Imperial Limestone (Texada Island)
- Lafarge Concrete (Vancouver Island Operations)
- Valley Rite Mix (Abbortsford)

4. First-aid Competitions

In 1976 a three-person first-aid team became the competitive standard, and the first Provincial Three-Persons' Miners First-Aid event was held in 1978. First-aid training is designed to aid a fellow worker in the event of an accident at the workplace; thus, the competition simulates this situation. One team member acts as the patient and the other two render first-aid. The St. John Standard course was adopted as the training standard and only those who work in or about a mine are permitted to enter. Winners of the first-aid competitions in 1986-1987 were as follows.

East Kootenay Mine and Industrial Safety Association:

1986 - Cominco Ltd. (Sullivan Mine)
1987 - Fording Coal Ltd.

South/Central B.C. Mining Association:

1986 - Newmont Mines and Utah Mines Ltd.
1987 - Utah Mines Ltd. and Westmin Resources

North B.C. Mine Safety Association:

1986 - Quintette Coal Ltd. and Equity Silver Mines Ltd.
1987 - Bullmoose Operating Corp. and Cassiar Mining Corp.

West Kootenay Mine and Industrial Safety Association:

1986 - Cominco, Sullivan Mine
1987 - No competition

Vancouver Island Mine and Industrial Safety Association:

Teams normally in this zone competed in the South/Central B.C. Mining Association competitions.

5. John T. Ryan Trophies

The John T. Ryan safety trophies were established in 1941 by the Mine Safety Appliance Company of Canada Limited to promote safety in Canadian metalliferous and coal mines. The administration of these annual awards is conducted by the Canadian Institute of Mining and Metallurgy.

There have been a number of changes in the regulations and qualifications over the years; however, there are now three categories open for annual competition.

1. Metalliferous Underground Mines - includes a Canadian trophy and four regional trophies. B.C. mines compete in the B.C. and Yukon Region.

2. Select Mines - includes open-pit and strip mines for any mineral including coal. This has a Canadian trophy and two regional trophies. B.C. Select Mines compete in the Western Region which includes all Canada west of the Manitoba-Ontario border.

3. Coal Mines - restricted to underground mines. There is a single Canadian trophy in this category.

Applications for these awards are submitted annually through the Chief Inspector of Mines. Awards are presented to the company or companies having the least number of compensable accidents in a continuous period in which 500,000 man-hours (120,000 for underground coal mines) of employment are recorded. If the 500,000 man-hours cannot be achieved in one year, they may be accumulated over a longer continuous time period but the complete calendar year must be included. No portion of that period may be used in another application for the same award. A fatality causes automatic disqualification for the period in which it occurs.

The winners of these trophies were as follows:

Metalliferous Underground Mines, regional trophy:

1986 - Westmin Resources Ltd., Myra Falls
1987 - Westmin Resources Ltd., Myra Falls

Select Mines, regional trophy:

1986 - Equity Silver Mines Ltd.
1987 - Equity Silver Mines Ltd.

There are no underground coal mines in British Columbia.

RECLAMATION

As regulated pursuant to the Mines Act, reclamation involves the restoration of disturbed lands and water bodies to a mutually agreed use (or standard) following exploration and/or mining. Reclamation requirements do not apply to land disturbed prior to legislation in April, 1969.

Security deposits are required as a condition of all reclamation permits to ensure that reclamation programs are adequately completed. Permits are issued by the Minister for coal mines, metal mines, and coal exploration. The Chief Inspector of Mines issues reclamation permits for mineral exploration , gravel pits, quarries and placer mining.

Reclamation permits specify requirements for seeding and fertilizing of disturbed land, restoration of water courses, and dismantling of buildings and other structures. To provide a technical framework for sound reclamation planning, the Ministry of Energy, Mines and Petroleum Resources has published mine reclamation, coal exploration and mineral exploration guidelines.

The work of the Reclamation Advisory Committee, an inter-ministerial committee established under the Mines Act to review reclamation programs, has been aided through the creation of two additional sub-committees based in Nanaimo and Smithers. These two regional sub-committees, as well as two established in the northeast and southeast coal blocks, review all annual coal exploration proposals and are available to review reclamation matters at major mines in their areas.

Reclamation staff also work in close cooperation with members of industry and universities through the Technical and Research Committee on Reclamation. This committee has been active in supporting reclamation research and information exchange to ensure that technological advances in reclamation are disseminated rapidly throughout the mining industry.

A reclamation symposium is organized annually and sponsored by the Ministry of Energy, Mines and Petroleum Resources in conjunction with the Mining Association of British Columbia and, in 1981, the Canadian Land Reclamation Association. Several hundred delegates attend presentations on many aspects of mine land reclamation, an award and citations are presented to companies who voluntarily exceed the requirements of the Mines Act in the performance of their reclamation programs.

The following table shows the recipients of awards and citations for 1981-1987.

Mine Reclamation Symposium Awards and Citations

Year	Award	Citation
1981	Utah Mines Ltd. (Island Copper Mine)	Newmont Mines Ltd. (Similkameen Division) Sage Creek Coal B.C. Coal Ltd.
1982	Crows Nest Resources Ltd. (Line Creek Mine)	Fording Coal Ltd. (Fording River) Cominco Ltd. (Pinchi Lake) B.C. Coal Ltd.
1983	Westar Mining Ltd. (B.C. Coal) (Environmental Services)	Crows Nest Resources Ltd. Fording Coal Ltd. Craigmont Mines
1984	Utah Mines Ltd. (Island Copper Mine)	Crows Nest Resources Ltd. (Line Creek Mine) Crows Nest Resources Ltd. (Telkwa exploration) Equity Silver Mines Ltd.
1985	Quintette Coal Ltd. (Quintette Mine)	Lornex Mining Corp. (Highland Valley Mine) Crows Nest Resources Ltd. (Line Creek Mine) Canada Wide Mines Ltd. (Granduc Operation) Marathon Realty (gravel pit reclamation) A.F. Savage (placer mining)
1986	Byron Creek Collieries Ltd. (Coal Mountain Mine)	Utah Mines Ltd. (Island Copper Mine) Crows Nest Resources Ltd. (Line Creek Mine)
1987	Equity Silver Ltd. (Equity Silver Mine)	Afton Mines Ltd. (Afton Mine) Westar Mining Ltd. (Balmer Mine)

On a provincial basis, the pace of reclamation has increased significantly since the introduction of legislation. Prior to 1969, most disturbed lands were not reclaimed. However, by the early 1980s the ratio of reclaimed to disturbed lands had risen, especially in regard to coal lands where the ratio fluctuated between 20 per cent and 30 per cent. This ratio tends to fall in years when new mines commence construction, since this involves large new disturbances which it may not be possible to reclaim for some years. However, overall reclamation is now keeping pace with disturbance.

In the early to mid-1980s the troubled economy resulted in a large number of temporary and permanent closures of metal mines, which heightened final reclamation activity at several of these mine sites.

The data used to compile the following record of disturbance and reclamation at mine sites have been submitted by mining companies in their annual reclamation reports to the Ministry. The reader is advised that an industry audit which is to be conducted could alter some data.

Reclamation data reported in upcoming editions of Mining in British Columbia will reflect any revised submissions.

Mining Land Disturbance and Reclamation, 1969 - 1987
(Cumulative Hectares)

Year	Disturbed			Reclaimed			Balance
	Coal Mines	Metal Mines	Total	Coal Mines	Metal Mines	Total	
1969	0	144	144	0	0	0	144
1970	0	379	379	50	0	50	329
1971	0	834	834	106	2	108	726
1972	234	886	1120	200	2	202	918
1973	234	2490	2724	280	109	389	2335
1974	260	2625	2885	386	109	495	2390
1975	1271	3851	5122	462	144	606	4516
1976	1320	5179	6499	584	275	859	5640
1977	1888	7366	9254	752	382	1134	8120
1978	2180	8114	10294	1045	586	1631	8663
1979	2320	11468	13788	1273	904	2177	11611
1980	4263	11579	15842	1137	1036	2173	13669
1981	4833	13543	18376	1333	1271	2604	15772
1982	6701	13346	20047	1536	1393	2929	17119
1983	7563	13228	20791	1842	1451	3294	17497
1984	8271	13577	21848	2242	1614	3856	17992
1985	9156	14093	23249	2276	1730	4007	19242
1986	9950	14307	24257	2450	1772	4223	20034
1987	12060	13965	26025	3859	1842	5701	20324

In 1981, the Ministry funded a reclamation land use study of the Highland Valley as part of an M.Sc. thesis at the University of British Columbia. The Ministry continued to fund the Princeton tailings irrigation project where approximately 41 tonnes of alfalfa were harvested from the twelve hectares under irrigation. This was almost three times more than the previous harvest.

In 1982, the Guidelines for Mineral Exploration were issued.

The proclamation of the Mines Act, effective June 30, 1983, required several administrative changes with regard to sand and gravel pits and quarries, including the requirement that applicants must publish a Notice of Filing in the B.C. Gazette and local newspapers allowing public response to the proposed project. Also in 1983, a special citation was presented to Dr. J.C. Errington of the Ministry's Reclamation Section at the Annual Mine Reclamation Symposium.

Mine reclamation guidelines were formally issued by the Minister on March 1, 1984. These guidelines, which provide for high yet reasonable standards of achievement, follow the philosophy of the Mines Act. They allow for programs to be developed by industry for approval based upon recommendations of the Reclamation Advisory Committee, and upon response from interested parties. The land use and productivity objectives which are referred to are negotiable on a project-by-project basis.

In 1986, the Reclamation Section played a lead role in organizing the first International Symposium on Flow-Through Rock Drains. This symposium was held in Cranbrook and saw participation from Australia, Russia, France and the United States. The advantages of flow-through rock drains are twofold: the savings to industry involve many millions of dollars; and the practice eliminates environmental disturbance associated with lengthy diversion ditches. The symposium confirmed that the technology adequately addressed both function and long-term stability, and established British Columbia's coal mining industry as a world leader in its introduction and implementation.

At the 1987 Mine Reclamation Symposium in Campbell River, the theme of acid mine drainage attracted a large audience. Papers were drawn from across Canada, although the major focus was on British Columbia's problems with acid mine drainage from surface works and waste dumps. Westmin Resources Ltd. hosted a field trip to its Myra Falls mine west of Campbell River, where participants observed effective measures taken to treat acid mine drainage.

GEOTECHNICAL/ROADS

The Geotechnical/Roads Section was formed in 1985 as an amalgamation of the Geotechnical Section and the Roads Section. The Section was staffed by the Senior Geotechnical Inspector, who directed the Section, and one certified technician. In addition to its regular activities, the Section collaborated with the Reclamation Section during 1986 in a project to control objectionable seepages from an abandoned dump at Mount Washington, Vancouver Island.

At the end of 1986, the Section was dissolved. The separate Geotechnical Section and Roads Section were re-established.

Geotechnical

The duties of the Geotechnical Subsection involve the inspection of works at mines and the assessment and regulation of geotechnical designs. The structures monitored include tailings impoundments, waste rock dumps, spoil piles or stockpiles, and pit slopes. Other projects of concern are water-retaining and water-controlling works.

1986

The number of projects recommended to the Chief Inspector for approval dropped to 11, down from 18 in 1985, and several projects were rejected or delayed. There was a total of 21 completed projects, including the recommended approvals, that involved general mine plans, tailings impoundments, dumps or piles, and other features.

The trend of decreasing inspections continued in 1986, with the number falling to 12 from 14 in 1985. The number of properties inspected actually declined by four as two properties were inspected twice. The number of geotechnical features examined fell to 16 from 28 in 1985. The persistent decline in inspections is attributed in part to uncertainties in the budget for travel and in the objectives of the Subsection.

The number of mines in the province with active waste disposals increased to 27. The number of active tailings ponds increased to 23 and the number of active dumps or spoil piles remained unchanged. The increases are due to the re-activation of several former mining operations, and to the new Blackdome gold mine.

There were two dump failures at the Quintette coal mine in June involving nearly two million cubic metres of waste rock, and one at Fording coal mine. Pitslope failures interrupted operations throughout the year at Afton mine. Other concerns included the washout of several overflow dykes in the sedimentation ponds at Line Creek mine, and the breach of the tailings impoundment at the Mineral King operation. The most dangerous problem encountered during the year was the condition of the new tailings dam at Taurus gold mine. Engineering advice was sought and repairs ordered, but by the end of the year all terms of the order had not been met.

1987

In 1987 most of the activity related to waste disposal from mines, with limited interest in open-pits. The number of mines with active waste disposals increased to 29, with a total of 24 tailings emplacements and 18 dumps or spoil piles. This increase was continuing at the end of the year as new operations received approval and commenced construction.

The recent trend of decreasing inspections was reversed as the total number increased to 20, up from 12 in 1986. The majority of these inspections were of tailings emplacements. Fewer visits occurred but more investigations were undertaken, and 16 approvals were recommended and one rejected. Other projects included 21 reviews under the Mine Development Review Process, and internal or administrative work.

Geotechnical incidents investigated during the year include the appearance of a sinkhole in the tailings beach at Bell Copper mine, and breaches of the tailings dykes at Erickson gold mine. Washouts of a portion of a tailings dam had occurred at the Endako mine and several soft spots and a cavitation at the toe were noticed. As a result, an order to have an engineering review was issued and repairs were eventually implemented.

A crack was discovered in the footwall of the Cougar pit at Greenhills coal mine, and there was a rockfall on the footwall at Line Creek coal mine. In addition, there was an instability from the previous year in the highwall at the Balmer J1 pit and a washout of a decant at Taurus gold mine.

The no.2 spoil pile at Fording River coal mine failed, and there was another major failure at a Quintette coal mine dump (Wolverine). The Section was involved in the review of a complaint by a union about safety procedures at the Quintette mine.

A program to collect data for a register of tailings dams was initiated.

Roads

Under the authority of the Ministry of Energy, Mines and Petroleum Resources Act, this Section operates the Mining and Petroleum Road Program to encourage and assist in the development of mineral resources through the development and maintenance of access roads.

1986

In 1986 the Section participated in three major study projects:

(1) The Omineca Road Extension from Moose Valley to the Lawyers property, a distance of 104 kilometres. The final road and bridge design was completed; however, Serem Inc. did not proceed with the construction as planned.

(2) The Mount Klappan Road Access preliminary study was completed focussing on the preferred route through Sweeny Pass, a distance of approximately 102 kilometres.

(3) Mascot Gold Mines and the Ministry of Energy, Mines and Petroleum Resources entered into an agreement to share the cost of a joint road access study and design for 12 kilometres of road from Apex Ski Village to the Nickel Plate mine property. The Ministry contributed $11,000 to the project.

There were three other projects that received limited review for potential mining operations.

- The Kutcho Creek Access Road Study. The preferred south route for this project starts about five kilometres south of Dease Lake and proceeds east for approximately 110 kilometres to the Kutcho Creek area.

- The Cirque Property road access. This property is located about 30 kilometres northeast of the Finlay Bow airstrip, a project partially funded by the Ministry in 1981.

- The Golden Bear Road Access. A proposed road access is being reviewed to the property which is located about 135 kilometres west of Dease Lake, B.C.

The shared-cost road grant program for construction or maintenance of mining roads was not supported due to continuing budgetary restrictions.

1987

The Section continued to work on the projects from 1986.

(1) A loan agreement was worked out for the Omineca Road Extension and construction began in June.

(2) The Mount Klappan Road Access study was completed; however, no further action was initiated on the project.

(3) Mascot Gold Mines and the Ministry of Energy, Mines and Petroleum Resources completed the road access study to the Nickel Plate mine property; the company constructed the access.

The Golden Bear Road Access continued to be studied as all the proposed routes were submitted.

The Cirque Property Road Access Study and the Kutcho Creek Road Access Study continued to receive limited review.

The reclamation project at the Mount Washington minesite was referred to the Roads Section for review, and for assistance in locating possible sources of till to be used in reclamation. In addition, cost estimates were required for reclamation of the haul roads built from various till sites.

The shared-cost road grant program for construction or maintenance of mining roads was not supported due to continuing budgetary restrictions.

PART 2 - MINE PRODUCTION

INTRODUCTION

Following the format used in previous editions of Mining in British Columbia, metal and coal mines are listed in alphabetical order by Mining Division, while non-metallic mines are listed by commodity. The Mining Divisions are shown in Figure 2.

Property locations are given precisely by latitude and longitude, and the general geographic position by reference to an NTS map sheet. Figure 3 shows the location of all the metal mines described herein, and Figure 4 shows the location of coal mines. The properties are numbered sequentially as they appear in the text.

References are to publications of the Ministry and the Department of Mines, and to relevant articles in publications readily available in libraries. The notation MI refers to the Mineral Inventory, a continuing record (MINFILE) of hard-copy and computerized data relating to mineral properties in the Province. It is the basic data file which has been kept by the Ministry for over a century and which has been available to the public in its present form since 1977.

MINING DIVISIONS

1 Alberni
2 Atlin
3 Cariboo
4 Clinton
5 Fort Steele
6 Golden
7 Greenwood
8 Kamloops
9 Liard
10 Lillooet
11 Nanaimo
12 Nelson
13 New Westminster
14 Nicola
15 Omineca
16 Osoyoos
17 Revelstoke
18 Similkameen
19 Skeena
20 Slocan
21 Trail Creek
22 Vancouver
23 Vernon
24 Victoria

• Gold Commissioner's Office

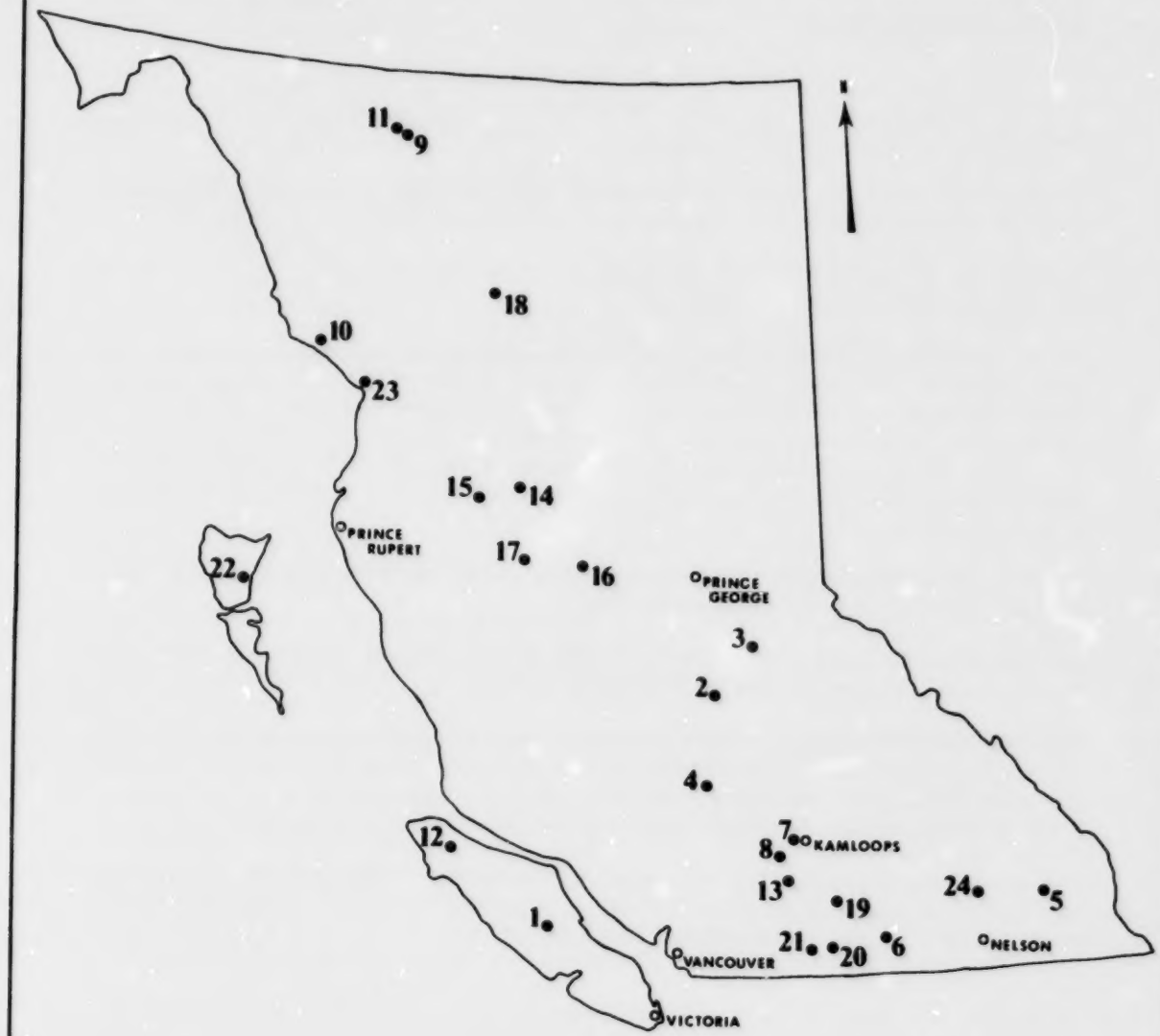
(Gold Commissioner's Office for Liard Mining Division is in Victoria)

scale
0 500
kilometres

Figure 2

METAL MINES

producers and selected potential producers



1 Myra Falls Operation
2 Gibraltar
3 Mosquito Creek
4 Blackdome
5 Sullivan
6 Beaverdell
7 Afton
8 Highland Valley Copper
9 Erickson Gold
10 Johnny Mountain*
11 Taurus Gold
12 Island Copper
13 Craigmont
14 Bell Copper
15 Duthie
16 Endako
17 Equity Silver
18 Lawyers*
19 Brenda
20 Nickel Plate
21 Similkameen
22 Cinola*
23 Premier Gold Project*
24 Silvana

*potential producer

scale
0 100 200 300 400 500
kilometres

Figure 3

ALBERNI MINING DIVISION

MYRA FALLS OPERATION (Lynx, H-W)
(Fig.3, No.1)

Alberni M.D. Lat.49°34' Long.125°35' (92F/12E)

The Myra Falls Operation is located on the west side of the south end of Buttle Lake, 60 kilometres southwest of Campbell River, B.C. Access is via 88 kilometres of road from Campbell River.

The operation is owned by Westmin Resources Ltd., Suite 1800, Bow Valley Square III, 255-5th Avenue S.W., Calgary, Alberta, T2P 3G6.

The ore deposits consist of massive sulphides, including pyrite, chalcopyrite, sphalerite, and galena, occuring in volcanic rocks of the Sicker Group. The Lynx mine is within a single structural stratigraphic zone 400 to 500 metres thick, which has been traced over a strike length of 6,000 metres. The mine area comprises segments of a zone of rhyolite, other volcanic rocks, and ore. The H-W mine is at a stratigraphic level 100 metres lower. In this area, rocks ranging from massive volcanic rock to breccias, tuffs, and clastic sediments have been affected by dynamothermal metamorphism.

Four separate underground mines have existed at this site: the Myra, Price, Lynx and H-W mines. Only the Lynx and H-W mines are now producing.

The Lynx mine produced approximately 22% of the total for the complex in 1986, and 18% in 1987. The mine uses both room and pillar, and cut and fill, methods.

The H-W mine/mill expansion, which started up in 1985, operated throughout 1986-1987 at an average production rate of 2,955 tonnes/day in 1986, and 3,018 tonnes/day in 1987. During 1986, the underground shops, warehouse, mechanical office and other facilities were completed. A further expansion of the H-W complex is planned to increase capacity to 4,000 tonnes/day.

References: *Minister of Mines, B.C.*, Ann. Rept.,1964, pp.157-166; *CIM*, Bull., Dec.1980, pp.71-90; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.1-2; Mining in British Columbia, 1981-1985, p.2; MI 92F-71, 72, 73.

MYRA FALLS OPERATION (Lynx, H-W)

	1986	1987
Ore Shipped or Treated (t)	1,066,664	1,089,796
Product Shipped (t)		
Copper concentrates (t)	90,161	100,246
Zinc concentrates (t)	100,814	86,508
Gross Metal Content		
Gold (g)	1,704,588	1,322,033
Silver (g)	43,637,121	31,757,428
Copper (Kg)	24,726,110	25,145,000
Lead (Kg)	4,490,731	3,371,000
Zinc (Kg)	56,849,571	47,581,000

CARIBOO MINING DIVISION

GIBRALTAR
(Fig.3, No.2)

Cariboo M.D. Lat.52°30' Long.122°16' (93B/9W)

The property is located approximately 161 kilometres south of Prince George, B.C., and 16 kilometres east of McLeese Lake, B.C., on the west side of Granite Mountain by Granite Creek. Access is via a paved road which connects to Highway 97 at McLeese Lake.

The operation is 68.1% owned by Placer Dome Inc., Gibraltar Mine Division, P.O. Box 49330, Bentall Postal Station, 1600-1055 Dunsmuir Street, Vancouver, B.C., V7X 1P1.

The ore zone is a porphyry copper-rich deposit, occurring within a Triassic pluton of variable composition. The mine phase, which contains the ore zone, is a quartz diorite that has been altered and deformed. Mineralization took place during a complex history of deformation which involved the folding of mineralized foliations. Four orebodies are known: Gibraltar East, Gibraltar West, Granite Lake, and Pollyanna. Ore minerals are chalcopyrite and molybdenite; however, the Gibraltar East and Pollyanna pits have well-defined zones containing supergene chalcocite.

This is a large open-pit operation that first began production in 1972. In 1986, a solvent-extraction and electrowin plant was completed which leaches copper from waste dumps. The plant began producing high quality cathode copper in October, 1986, and operated throughout 1987 at a rate in excess of 4.5 million kg/year. Improved copper prices by the end of 1987 led to proven reserves being revised to 117.5 million tons.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1973, pp.299-318; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.3-4; Mining in British Columbia, 1981-1985, pp.3-4; MI 93B-6, 7, 12, 13.

GIBRALTAR

	1986	1987
Ore Shipped or Treated (t)	12,182,335	12,575,334
Product Shipped (t)		
Copper concentrates (t)	98,367	101,587
Copper cathode (t)	-	3,972
Molybdic oxide (t)	1,472	408
Gross Metal Content		
Gold (g)	49,050	26,936
Silver (g)	7,042,574	3,972,132
Copper (Kg)	37,617,000	35,428,740
Molybdenum (Kg)	792,057	449,478

MOSQUITO CREEK
(Fig.3, No.3)

Cariboo M.D. Lat.53°07' Long.121°36' (93H/4E)

The property is located approximately three kilometres west of Wells, B.C., on the east side of Island Mountain.

The mine is owned by Mosquito Creek Gold Mining Company Ltd., 550 Bow Valley Square 3, 255-5th Avenue S.W., Calgary, Alberta, T2P 3G6.

The area lies within the Snowshoe formation of the Cariboo Group. Gold is found in two distinct zones: "Rainbow" and "Baker". The Rainbow bed is composed of dark quartzites, argillites, and some phyllites. Tension fractures have developed normal to the bedding which are filled with gold-bearing quartz and pyrite. The Baker member is composed of light, fine-grained calcareous quartzites, talcose rocks, and interbedded limestones. The limestones have been replaced by gold-bearing sulphides, generally in the bed nearest the Rainbow-Baker contact.

This is an underground gold mine, with minor silver values also present. Normal mining operations terminated on January 31, 1986, and milling operations terminated on February 16, 1986.

During 1986, the Hecla Mining Company of Canada optioned the Mosquito Creek and Island Mountain claim groups from the Mosquito Creek Gold Mining Company Ltd. An exploration project was undertaken, consisting of 345m of development and 2436m of percussion drilling in the mine. Exploration was partly financed by a B.C. FAME grant.

In the fall of 1986, Phase I of a salvage mining and batch milling project was carried out. The mill operated from October 20 to November 13 inclusive. Phase II was begun in late 1986, and both Phase II and III were completed in 1987. In addition, from July to November, 1987, a salvage project was carried out to recover gold from the old mill site of the Cariboo Gold Quartz Mining Company Ltd. This clean-up greatly enhanced the appearance and reduced the hazards at the site.

Activities at the mine ceased on November 27, 1987, and it was placed on a care and maintenance basis.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.4-5; Mining in British Columbia, 1981-1985, p.4; MI 93H-10.

MOSQUITO CREEK

	1986	1987
Ore Shipped or Treated (t)	4,285	4,672
Product Shipped (t)		
Gold bullion		
Gross Metal Content		
Gold (g)	74,875	53,755
Silver (g)	1,786	18,590

CLINTON MINING DIVISION

BLACKDOME
(Fig.3, No.4)

Clinton M.D. Lat.51°20' Long.122°29' (92O/8W)

The property is located near the peak of Blackdome Mountain, 70 kilometres northwest of Clinton, B.C. Access is via a road off Highway 97 which crosses the Fraser River near Gang Ranch.

The mine is owned by Blackdome Mining Corporation, 852-409 Granville Street, Vancouver, B.C., V6C 1T2.

The deposits occur within a gently dipping sequence of Tertiary volcanic and volcanoclastic formations, transected by steeply dipping northeast-trending normal faults. The fault zones have provided channels for epithermal mineralization, and contain variable amounts of gouge, clay alteration, silicification, and gold-silver bearing quartz veining. The mineralized volcanics are overlain by younger basalts which form the crest of Blackdome Mountain. Gold and silver mineralization usually consists of less than one percent dissemination of fine- to medium-grained electrum, acanthite, tetrahedrite, friebergite, chalcopyrite, pyrite, and silver sulphosalts. Quartz veining occurs as multiple stringers and stockworks up to 6 metres in width, and single veins up to 3 metres in width.

An extensive exploration program was carried out from 1981 to 1985, when development of the underground mine and plant construction was commenced. Plant construction and installation was completed in early 1986, and milling began on May 15. The mine officially opened in May, 1986, and reached full payback within nine months. Some 59% of the gold, and 12% of the silver, reports to bullion bars which are shipped to the Canadian Mint; flotation concentrates are sold to smelters.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.4-5; MI 92O-51

BLACKDOME

	1966	1967
Ore Shipped or Treated (t)	33,308	74,001
Product Shipped (t)		
Flotation concentrates (t)	221	422
Refinery slag (t)	16	54
Gross Metal Content		
Gold (g)	927,101	1,451,421
Silver (g)	2,451,161	3,929,689

FORT STEELE MINING DIVISION

SULLIVAN
(Fig.3, No.5)

Fort Steele M.D. Lat.49°42' Long.116°00' (82F/9E; 82G/12W)

The Sullivan mine and concentrator are located within the city limits of Kimberley, B.C. The mine is on Mark Creek, 3.2 kilometres north of the city centre, and the concentrator is 3.2 kilometres south of the city centre.

The operation is owned by Cominco Ltd., 200 Granville Street, Vancouver, B.C., V6C 2R2.

The Sullivan orebody, one of the largest base metal deposits in the world, is a lens-like body approximately 9,000 metres in diameter and 100 metres thick in its central part. It is tilted to the east, and conformable with the transition zone between the sedimentary rocks of the Lower and Middle Aldridge Formation.

The western part of the deposit lies directly above its conduit zone, the brecciated and altered footwall of the deposit. Linear, north-trending breccia zones, disseminated and vein sulphides, and extensive alteration to a dark, dense, chert-like tourmaline-rich rock are conspicuous features of the altered footwall. Albite-chlorite-pyrite alteration, restricted to the western part of the deposit, occurs in crosscutting zones in the footwall tourmalinite, within the orebody itself, and in the hangingwall up to 100 metres above the orebody.

The main sulphides are pyrrhotite, sphalerite, galena, and pyrite. Chalcopyrite and arsenopyrite are minor constituents. Boulangerite is locally prominent, magnetite is fairly common, and small amounts of cassiterite occur widely but are most common in the western part. In general, metal distribution patterns are directly related to the nearness of zones of chaotic breccia; higher absolute values, and higher lead-zinc and silver-lead ratios, overlie the breccia zones. The western part of the deposit is more massive than the eastern part, which includes five distinct, conformable layers of generally well-laminated sulphides separated by clastic (silty) rocks. The sulphide layers become thinner to the east, away from a transition zone between the western and eastern parts of the orebody, and, at the limits of the deposit, are composed of iron sulphide bands.

This operation has both underground and open-pit mining; however, the open pit has been inactive since 1983. The tin recovery circuit was shut down early in 1986, and total milling operations were shut down from June 28, 1986 to September 1, 1986 due to low prices and an oversupply of lead

and zinc on the world market. In 1987, operations were shut down from May 9 to September 1 due to a labour dispute.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.5-6; Mining in British Columbia, 1981-1985, p.5; MI 82F/NE-52.

SULLIVAN

	1986	1987
Ore Shipped or Treated (t)	1,859,100	1,686,600
Product Shipped (t)		
Lead concentrates (t)	127,600	98,048
Zinc concentrates (t)	176,200	130,919
Tin concentrates (t)	171	-
Gross Metal Content		
Silver (g)	81,753,684	70,836,084
Lead (Kg)	91,776,934	68,549,627
Zinc (Kg)	88,044,392	64,586,155

GREENWOOD MINING DIVISION

BEAVERDELL (Highland Bell)
(Fig.3, No.6)

Greenwood M.D. Lat.49°26' Long.119°04' (82E/6E)

The mine is situated on Wallace Mountain immediately east of Beaverdell, B.C., and 60 kilometres south of Kelowna, B.C.. The mill and tailings pond are located on the west side of the West Kettle River, and the concentrator is on the flat below Beaverdell.

The mine is owned by Teck Corporation, 1199 West Hastings Street, Vancouver, B.C., V6E 2K5.

The ore is contained in highly fractured and faulted quartz and calcite veins. These veins are found in a large body of quartz diorite which extends into the sedimentary Wallace formation to the east. The veins contain galena, sphalerite, chalcopyrite and pyrrhotite, with occurances of pyrargyrite and native silver. The mineralization may extend for short distances into the wall rock where it has been altered.

This underground mine is one of the oldest in the district having produced silver ore, almost without interuption, since 1900. The ore is mined using open stoping methods and is hauled approximately 6.5 kilometres to the concentrator. Three concentrates are produced, all of which are transported by truck to the smelter at Trail, B.C. In 1986, the company received a FAME grant to explore the 2900 level. The discoveries are now being mined.

References: *B.C. Minister of Mines*, Ann. Report 1949, pp.145-148; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1975-1980, Vol.1, p.8; Mining in British Columbia, 1981-1985, p.6; MI 82E/SW-30, 72, 133.

BEAVERDELL (Highland Bell)

	1986	1987
Ore Shipped or Treated (t)	34,119	36,352
Product Shipped (t)		
Lead concentrates (t)	372	420
Zinc concentrates (t)	168	196
Jig concentrates (t)	166	200
Gross Metal Content		
Gold (g)	3,763	9,331
Silver (g)	10,544,545	10,831,506
Copper (Kg)	1,266	1,572
Lead (Kg)	103,535	132,444
Zinc (Kg)	135,806	152,257

KAMLOOPS MINING DIVISION

AFTON
(Fig.3, No.7)

Kamloops M.D. Lat.50°39' Long.120°30' (92I/10E)

The Afton mine is alongside the Trans-Canada Highway, 13 kilometres west of Kamloops, B.C., at 640 metres elevation.

The mine is owned by Teck Corporation (73%), 1199 West Hastings Street, Vancouver, B.C., V6E 2K5.

The Afton copper deposit is at the northwestern extremity of the Iron Mask pluton, a sub-volcanic multiple intrusion of dioritic to syenitic composition. The orebody consists of a hypogene zone of bornite and chalcopyrite mineralization, and a supergene zone of native copper and chalcocite mineralization. Two kilometres southwest of the Afton Pit lies the Pothook orebody. This orebody consists mainly of chalcopyrite with significant quantities of chalcocite, bornite, and native copper.

This is a conventional open-pit mine and concentrator operation. During the 1986-87 period, mining of the remaining ore reserves in the Afton Pit was indefinately suspended. The Pothook Pit was mined at an average grade of 0.39% copper; however, mining of this pit was expected to be completed by June, 1988. The Ajax orebody, approximately ten kilometres southeast of the Afton mine, was extensively explored, and a mining plan was being developed at the end of 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1972, pp.209-220; *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.376-387; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol. 1, 1975-1980, pp.11-12; Mining in British Columbia, 1981-1985, p.7; MI 92I/NE-23.

AFTON

	1986	1987
Ore Shipped or Treated (t)	2,693,784	2,861,570
Product Shipped (t)		
Copper concentrates (t)	52,495	50,214
Gross Metal Content		
Gold (g)	1,814,266	1,496,295
Silver (g)	9,797,689	8,391,625
Copper (Kg)	21,853,185	19,805,639

HIGHLAND VALLEY COPPER
(Fig.3, No.8)

Kamloops M.D. Lat.50°29' Long.121°02' (92I/6E)

The property is located in the Highland Valley, 15 kilometres west of Logan Lake, B.C. It is accessed by highway from Ashcroft, Kamloops, and Merritt, B.C.

The mine is operated by Highland Valley Copper, P.O. Box 10024, Pacific Centre, 3000-700 West Georgia Street, Vancouver, B.C., V7Y 1A1, a partnership of Cominco, Lornex Mining Corporation Ltd. and the Highmont Mining Company.

The mine is situated in the central core of the Upper Triassic Guichon Creek batholith, which consists of several intrusive phases and varieties of calc-alkaline igneous rocks. The youngest phase (Bethsaida) is the host rock and is porphyritic granodiorite, medium- to coarse-grained, with coarse phenocrysts of quartz and biotite. The main sulphide minerals are bornite and chalcopyrite which are associated with a quartz-sericite stockwork system, as well as sericite-rich alteration zones. Pyrite and molybdenite form a weak halo around the edge of the orebody, and a relatively narrow oxide zone occurs in the upper portion of the orebody.

This open pit mine and mill operation is a merger of Cominco's Valley Copper orebody with the existing Valley and Lornex mills. In 1986, the Valley mill continued operation at 27,000 tonnes/day producing copper concentrates, while the Lornex mill, operating at 84,000 tonnes/day, produced both copper and molybdenum concentrates.

In 1987, two in-pit semi-mobile crushers and a conveyor system were installed in the Valley Pit area. These supply crushed ore to the Lornex concentrator, and to a loadout facility for truck haulage to the Bethlehem concentrator.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.8-9 (Lornex) and pp.9-10 (Valley Copper); MI 92I/SW12.

HIGHLAND VALLEY COPPER

	1986*	1987
Ore Shipped or Treated (t)	41,489,863	41,999,458
Product Shipped (t)		
Copper concentrates (t)	377,484	396,755
Molybdenite concentrates (t)	7,023	4,741
Gross Metal Content		
Gold (g)	115,361	296,416
Silver (g)	41,816,114	46,366,979
Copper (Kg)	142,372,560	161,897,636

* Includes figures for Highland Valley Copper, Lornex and Valley.

LIARD MINING DIVISION

ERICKSON GOLD
(Fig.3, No.9)

Liard M.D. Lat.59°13.5' Long.129°39' (104P/4E)

The property is located 12 kilometres southeast of Cassiar, B.C., adjacent to McDame Lake.

The mine is owned and operated by Total Erickson Resources Ltd., 1500-700 West Pender Street, Vancouver, B.C., V6C 1G8.

This is a mesothermal volcanic-hosted multi-vein type underground mine. Gold and silver values in the Jennie quartz vein are contained in metallic gold, pyrite, tetrahedrite, chalcopyrite, and small amounts of galena and sphalerite. The vein is from a few centimetres to nine metres wide, with an average of one metre. Enclosing rocks are interbedded volcanic and sedimentary. A fine-grained dyke parallels the vein. In the southern part of the property the main mineralization occurs in quartz veins of varying width, length, and grade, which generally follow steeply dipping faults. The veins contain occasional coarse, visible gold, minor tetrahedrite, galena, pyrite, and siderite, and are frequently accompanied by a mariposite wallrock alteration. Minor gold values have also been reported from sulphide stringers and chert breccia zones.

The mine went into production in December, 1978. Mining methods used include shrinkage stope, modified room and pillar and selective open-pitting. In January, 1986, the Erickson mill was destroyed by fire. Construction of a new mill, with a design capacity of 273 tonnes/day, was completed in October, 1986. During the third quarter, 1986, ore was processed at the milling facilities of Taurus Resources Ltd. Gold production in 1987 set a record for the mine.

In 1984, Erickson acquired property from Cusac Industries Ltd. located in the southern part of the Erickson Gold Camp. During the 1986-1987 period, exploration drilling on this property has been particularly successful on the Eileen, Michelle Extension and Katherine vein systems.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.15; Mining in British Columbia, 1981-1985, p.10; MI 104P-29.

ERICKSON GOLD

	1986	1987
Ore Shipped or Treated (t)	24,645	86,346
Product Shipped (t)		
Gold concentrates (t)	n/a*	2,193
Gross Metal Content		
Gold (g)	720,926	1,143,026
Silver (g)	243,700	523,190

* not available.

JOHNNY MOUNTAIN
(Fig.3, No.10)

Liard M.D. Lat.56°38' Long.131°04' (104B/11E)

The property is located 280 kilometres north of Terrace, B.C., on the northwest slope of Johnny Mountain. Access is by air only.

The mine is being developed by Skyline Explorations Ltd., 301-675 West Hastings Street, Vancouver, B.C., V6B 1N2.

Visible native gold is common and is the main economic mineral. Associated minerals include pyrite, chalcopyrite and some sphalerite and galena. Quartz and microcline are the main gangue components of the veins. Mineralization is localized in at least three significant vein systems which represent staged, high temperature deposition related to syenitic plutonism of early Lower Jurassic age.

A Stage I Report was completed, and Approval-In-Principle granted, in 1987. The mine is scheduled to come into production in the fall of 1988. The company is undertaking preproduction mine development. A 181 tonne/day mill and related surface structures, including a warehouse, service building and accomodation facilities, are under construction.

References: MI 104B-107

TAURUS GOLD
(Fig.3, No.11)

Liard M.D. Lat.59°16' Long.129°42' (104P/5E)

The property is located 9.6 kilometres southeast of Cassiar, B.C., and about four kilometres west of Highway 37. It is accessed via seven kilometres of road off Highway 37.

The mine is owned by Taurus Resources Ltd., 1110-625 Howe Street, Vancouver, B.C., V0C 1E0.

The ore minerals are contained in quartz veins and include free gold, auriferous pyrite, tetrahedrite, chalcopyrite, and minor amounts of galena and sphalerite. The veins vary from a few centimetres to one metre in width. The enclosing rocks are interbedded volcanics and sedimentaries.

Mine and mill production began in 1981 using underground shrinkage stoping mining methods. Mill capacity was increased in 1984 and a cyanidation plant installed in 1985. Production continued throughout 1986 and 1987. During the third quarter, 1986, ore from the Erickson Gold mine was processed at the Taurus milling facilities.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.11; MI 104P-12.

TAURUS GOLD

	1986	1987
Ore Shipped or Treated (t)	37,145*	37,552
Product Shipped (t)		
Gold bullion (1986)		
Flotation (t)		566
Cathodes (t)		440
Jig not reported		
Gross Metal Content		
Gold (g)	121,380	91,519

* Does not include 10,692t of custom ore.

NANAIMO MINING DIVISION

ISLAND COPPER
(Fig.3, No.12)

Nanaimo M.D. Lat.50°36' Long.127°28' (92L/11W,12E)

The property is located on Vancouver Island, 16 kilometres south of Port Hardy, B.C., and 8 kilometres east of Coal Harbour, B.C., on the north shore of Rupert Inlet. It is accessed by road from Port Hardy.

The mine is owned by BHP-Utah Minerals International Inc., 550 California Street, San Francisco, California, 94104.

The orebody is an elongated ellipse, subparallel to the regional trend. It occurs within rocks of the Bonanza Group, including coarse to fine andesitic to dacite breccias and tuffs. Intrusive into the volcanic rocks is an irregular dyke of quartz-feldspar porphyry which dips at 45°-60° to the north. The orebody is draped about the dyke. The ore zone is strongly fractured, with chalcopyrite and molybdenite occurring in veinlets. About 75% of the ore is in volcanic rocks and the remainder, on both sides of the dyke, is in marginal breccia.

Production began from this open pit in late 1971; copper concentrate and molybdenum concentrate are produced. The copper concentrate is shipped to smelters in Japan, while the molybdenum concentrate is dried, packaged into steel drums and trucked to Vancouver. Shipments to overseas markets are made through an adjacent port facility on Rupert Island.
References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.206-218; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.16-17; Mining in British Columbia, 1981-1985, p.12; MI 92L-158.

ISLAND COPPER

	1986	1987
Ore Shipped or Treated (t)	17,123,000	18,837,431
Product Shipped (t)		
Copper concentrates (t)	219,180	222,193
Molybdenite concentrates (t)	4,266	3,194
Gross Metal Content		
Gold (g)	1,681,106	1,401,616
Silver (g)	13,605,641	12,896,064
Copper (Kg)	55,730,718	56,964,532
Molybdenum (Kg)	1,950,817	1,503,310

NICOLA MINING DIVISION

CRAIGMONT
(Fig.3, No.13)

Nicola M.D. Lat.50°12.5' Long.120°56' (92I/2W)

The property is located 16 kilometres northwest of Merritt, B.C., and is accessed by a branch road from the highway at Lower Nicola.

The mine is owned by Craigmont Mines Ltd., 700-1030 West Georgia Street, Vancouver, B.C., V6E 2Y3.

The Craigmont orebodies are pyrometasomatic copper deposits, mainly in limey bedded rocks, lying within the thermal aureole of the southern end of the Guichon Creek batholith. Alteration of the rock is intense and varies somewhat with the original rock type. The ore is believed to be localized in sedimentary zones characterized by medium- to coarse-grained clastic rocks. Bands of limestone are not characteristically mineralized. The deposit can be termed a skarn because of the intensity of alteration and the presence of iron oxides, either magnetite, or hermatite, or both.

Mining ceased in February, 1982, as reserves were exhausted. The concentrator remained in operation, using the copper and iron ore stockpiles, until November, 1982, when it was shut down. During 1986 and 1987 no milling took place but iron concentrate was shipped.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1974, pp.127-130; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.20-21; Mining in British Columbia, 1981-1985, p.13-14; MI 92I/SE-35.

CRAIGMONT

	1986	1987
Ore Shipped or Treated (t)	no milling	no milling
Product Shipped (t)		
Iron concentrates (t)	35,821	32,300

OMINECA MINING DIVISION

BELL COPPER
(Fig.3, No.14)

Omineca M.D. Lat.55°00' Long.126°14' (93M/1E; 93L/16)

The property is located at the north end of the Newman Peninsula on Babine Lake, approximately 70 kilometres northeast of Smithers, B.C., and 16 kilometres north of Granisle, B.C.

The mine is owned by Noranda Minerals Inc., Bell Copper Division, Granisle, B.C.

The Bell orebody is an elliptical intrusion of biotite feldspar porphyry, 730 by 365 metres in size. Copper mineralization occurs overlapping the western and northern contacts of the stock, giving the deposit a crescent shape. The sediments and volcanics are generally hornfelsed, and all units have undergone intense hydrothermal alteration. The mineralization is primarily chalcopyrite which occurs in a dense quartz stockwork as disseminations and fracture fillings. Pyrite forms from eight to fifteen per cent of the rock in the ore zone. Also, a zone of supergene enrichment exists, with chalcocite common as much as 60 metres below the surface. Assorted copper oxides and carbonates make up five to ten per cent of the total copper content of the upper part of the deposit. Minor amounts of gold and silver are associated with the chalcopyrite.

The mine, which uses conventional open-pit methods, was re-opened in September, 1985, after being closed due to low copper prices. In 1986, diamond drilling programs conducted in the immediate pit area outlined sufficient ore to undertake a push back on the north and west pit walls, leading to an increase of about one year in the projected mine life. The mine remained only marginally profitable throughout 1986 and most of 1987; however, the significant increase in the world copper price during the last quarter of 1987 improved its situation greatly.

References: *Minister of Mines*, B.C. Annual Report 1965, pp.99-102; *Dept. of Mines and Pet. Res.*, GEM, 1969, p.114; 1970, p.170; 1971, pp.185-186; 1972, pp.426-428; 1973, pp.352-353; 1974, p.266; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.21-22; Mining in British Columbia, 1981-1985, p.15; MI 93M-1.

BELL COPPER

	1986	1987
Ore Shipped or Treated (t)	5,333,126	5,409,541
Product Shipped (t)		
Copper concentrates (t)	77,181	88,910
Gross Metal Content		
Gold (g)	745,426	892,514
Silver (g)	3,793,100	3,856,147
Copper (Kg)	21,433,848	23,396,427

DUTHIE
(Fig.3, No.15)

Omineca M.D. Lat.54°46' Long.127°21' (93L/14)

The property is located on the southwest slope of Hudson Bay Mountain, 11 kilometres west of Smithers, B.C. Access is via 20 kilometres of road from Smithers.

The mine is owned by Silver Standard Mines Ltd., 904-1199 West Hastings Street, Vancouver, B.C., V6E 3V4.

The three main ore zones (the Fault Plane, Henderson, and Ashman zones) are fault breccia zones where small, angular fragments have been replaced by sulphides. The veins dip sharply, and are bounded by competent hanging- and foot-wall rocks comprising massive, finely crystalline tuffs and andesite flow breccias. Mineralization includes ruby silver, freibergite, native silver, sphalerite, and argentiferous galena, with minor chalcopyrite and pyrite.

This small underground mine was worked from March to October 1986, producing about 500 tonnes of ore grading 27 oz/tonne silver, 4% lead and 5% zinc. The concentrator milled about 1000 tonnes, with half coming from old dumps. Work done in 1987 was largely exploration drilling, attempting to define sufficient ore for a rehabilitation program.

References: B.C. Report of Ministry of Mines, 1922-1930; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.22-23; Mining in British Columbia, 1981-1985, p.15; MI 93L-88.

ENDAKO
(Fig.3, No.16)

Omineca M.D. Lat.54°02' Long.125°07' (93K/3E)

The property is located ten kilometres southwest of Endako, B.C., and 160 kilometres west of Prince George, B.C., north of the east end of Francis Lake. Access is via paved road from Highway 16 just east of Endako.

The mine is owned by Placer Dome Inc., Endako Mines Division, P.O. Box 49330, Bentall Postal Station, 1600-1055 Dunsmuir Street, Vancouver, B.C., V7X 1P1.

This is an irregular and elongated orebody in Endako quartz monzonite, part of the Topley intrusions of Jurassic age. There has been pervasive kaolinization of the Endako quartz monzonite, which is intruded by a variety of premineral dykes and by postmineral basalt dykes. Molybdenite, pyrite, magnetite, and chalcopyrite are closely associated with quartz in veins and fracture fillings. Ore minerals occur in major quartz-molybdenum veins 15 centimetres to one metre wide.

This open-pit molybdenum mine, which uses truck and shovel methods, first opened in 1965. The mine and mill were shutdown in June 6, 1982 due to decreases in product price and depressed markets. The roaster continued to operate during the closure, roasting inventoried and toll product. The mine was re-opened in 1986, with continuous production from the concentrator being achieved in August. Operation was only at 35% of capacity until July, 1987, when it increased to 55%.

Over 90% of the ore was produced from the Denak East pit, which now has an expected life of two years. After this, ore will be produced from the North Wall of the Endako pit.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.444-454; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.23; Mining in British Columbia, 1981-1985, p.16; MI 93K-6.

ENDAKO

	1986	1987
Ore Shipped or Treated (t)	3,154,192	4,716,500
Product Shipped (t)		
Molybdenite concentrates (t)	232	219
Molybdic oxide (t)	518	3,409
Ferro-molybdenum (t)	65	277
Ammonium Di-molybdate (t)	447	195
Molybdenum sulphide (t)	-	109
Gross Metal Content		
Molybdenum (Kg)	826,027[1]	4,209,218[2]

[1] Includes 410,804 kg from own ores
[2] Includes 3,758,487 kg from own ores

EQUITY SILVER
(Fig.3, No.17)

Omineca M.D. Lat.54°11' Long.126°16' (93L/1W)

The property is located 40 kilometres southeast of Houston, B.C., and approximately 15 kilometres north of Francis Lake.

The operation is 58.8% owned by Placer Dome Inc., P.O. Box 49330, Bentall Postal Station, 1600-1055 Dunsmuir Street, Vancouver, B.C., V7X 1P1.

The ore zone is within a west-dipping dacitic volcanic pile of Mesozoic age. The Mesozoic rocks are intruded on the east by a Tertiary syenomonzonite stock. The base of the mine section is

quartz pebble conglomerate, above which is a layer of dacite pyroclastic breccia. Silver-copper mineralization, in the form of tetrahedrite and chalcopyrite, occurs in 5-100 metre wide shear and breccia zones within host alphanitic, brittle tuffaceous rock. Accessory sulphides associated with the ore-bearing minerals are pyrite, galena, sphalerite and arsenopyrite.

This is an open pit mine producing silver, gold and copper using conventional open-pit methods. During this period ore was produced from the Main Zone pit, with development of the Waterline Zone begun in late 1987. A mill expansion was completed in May, 1986, allowing ore to be treated more economically and increasing the average millfeed to 9,700 tonnes/day. However, the increased mill throughput reduced the expected mine life to five years. A major waste dump was started in the Bessemer Creek Valley. A new water treatment plant was constructed in 1987. Acid generation continues to be a concern both to the mine and to the regulating agengies.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, GEM, 1969, p.150; 1970, p.126; 1971, p.168; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.24-25; Mining in British Columbia, 1981-1985, p.16; MI 93L-1.

EQUITY SILVER

	1986	1987
Ore Shipped or Treated (t)	2,958,700	3,610,050
Product Shipped (t)		
Copper-silver-gold concentrates (t)	44,164	40,076
Gold concentrates (t)	-	1,216
Gross Metal Content		
Gold (g)	1,271,386	1,221,310
Silver (g)	165,280,641	156,079,319
Copper (Kg)	7,426,937	6,041,368

LAWYERS
(Fig.3, No.18)

Omineca M.D. Lat.57°20' Long.127°12' (94E/6)

The property is located approximately 280 kilometres north of Smithers, B.C., in the Toodoggone River area. Access is via the Omineca Mining Access road which extends northwest from Moosedale to the mine site.

The operation is owned by Cheni Gold Mines Inc. (formerly Serem Inc.), Box 11175, Royal Centre, 1055 West Georgia Street, Vancouver, B.C., V6E 3R5.

The eastern part of the property is underlain by quartz-andesite-crystal-lapilli-tuff which represents the remnant of a paleo-horst. The western part is underlain by volcano-sedimentary rocks of trachytic source, which represent a graben basin. Several gold-silver showings have been located, all associated with silicified filling of reactivated faults and fractures along the paleo-grabel margins. The three most promising showings (the Amethyst Gold Breccia Zone, the Cliff Creek Breccia Zone, and the Duke's Ridge Zone) are all within, or near, the area of trachyte volcanism deposited west of the paleo-horst.

No work was done in 1986; however, 1987 saw the completion of the access road and the start of the mine development plan. Site preparation for the camp and mill was completed along with some water diversion works. Camp and tailings impoundment construction was commenced.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.17-18; MI 94E-66.

OSOYOOS MINING DIVISION

BRENDA
(Fig.3, No.19)

Osoyoos M.D. Lat.49°53' Long.120°00' (92H/16E)

The Brenda mine operations are situated 22 kilometres northwest of Peachland, B.C., and 2.5 kilometres southwest of Brenda Lake. Access is via 29 kilometres of road (19 kilometres paved and 10 kilometres gravel) from Peachland.

The mine is owned by Noranda Inc., P.O. Box 45, Commerce Court West, Toronto, Ontario, M5L 1B6.

The orebody is within the Brenda Stock, a composite quartz diorite to granodiorite body of Jurassic age which intrudes rocks of the Upper Triassic Nicola Group. It is cut by pre-ore and post-ore dykes of divergent composition. Mineralization is confined almost entirely to veins, most of which are quartz veins. Chalcopyrite and molybdenite are the main sulphides, accompanied by minor and variable amounts of pyrite and magnetite. Grade is a function of the density of fracturing and mineralogy of the veins. Alteration is generally confined to narrow envelopes bordering veins.

The orebody is mined by conventional open-pit methods, and both copper concentrate and molybdenum concentrate are produced. The molybdenum concentrate is further upgraded by hot chloride leaching to reduce the presence of copper and lead.

After closing intermittently throughout 1982-84, the mine re-opened in September, 1985, helped by the Critical Industries Commission. The mine and concentrator operated in 1986 and 1987, operating at a rate of 30,000 tonnes/day in 1987. Exploration programs were completed in the south wall of the main pit and on the North Brenda claims, with the aid of a FAME grant. Follow-up studies confirmed the feasibility of extending production into 1990. Mineable reserves at the end of 1987 were 27,855,000 tonnes.

References: *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.186-194; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.26-27; Mining in British Columbia, 1981-1985, p.19; MI 92H/NE-47.

BRENDA

	1986	1987
Ore Shipped or Treated (t)	10,203,918	10,291,405
Product Shipped (t)		
Copper concentrates (t)	61,068	62,578
Molybdenite concentrates (t)	7,865	6,597
Gross Metal Content		
Gold (g)	131,065	134,837
Silver (g)	9,151,163	8,963,675
Copper (Kg)	16,996,076	17,725,664
Molybdenum (Kg)	4,361,280	4,361,280

NICKEL PLATE
(Fig.3, No.20)

Osoyoos M.D. Lat.49°22' Long.120°02' (92H/8E)

The property is located 6 kilometres north of Hedley, B.C., and is accessed via the Nickel Plate road from Hedley.

The mine is owned by Mascot Gold Mines Ltd., 900-837 West Hastings Street, Vancouver, B.C., V6C 1B6.

The ore occurs in beds of the Nickel Plate Formation, where silicification has taken place forming skarn minerals. Ore concentration is controlled by intrusive dioritic dykes and sills which separate the mineralized beds. Gold occurs as minute grains in association with arsenopyrite and bismuth tellurides, and as electrum associated with late stage intergrowths of chalcopyrite, pyrrhotite, and sphalerite. Silver, copper, and cobalt are lesser minerals.

This open-pit gold mine uses conventional mining methods. Milling operations began in April, 1987 upon completion of the 2450 tonne/day mill, the tailings dam, and ancillary facilities. The mine was officially opened on August 17, 1987, operating from three pits: the South (Bulldog) pit; the Central (Sunnyside) pit; and the North (Nickel Plate) pit. Ore is crushed, ground, and put through a 2-stage leaching and filtering process. Gold values are recovered from solution by zinc precipitation and refined to produce dore bullion.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.21; MI 92H/SE62.

NICKEL PLATE

	1986	1987
Ore Shipped or Treated (t)	-	481,454
Product Shipped (t)		
Gold bullion		
Gross Metal Content		
Gold (g)	-	1,512,428
Silver (g)	-	832,389

SIMILKAMEEN MINING DIVISION

SIMILKAMEEN (Newmont)
(Fig.3, No.21)

Similkameen M.D. Lat.49°20' Long.120°33' (92H/7E)

The Newmont copper deposit is located 24 kilometres south of Princeton, B.C., and is accessed via Highway #3 East and the Copper Mountain road. The concentrator is located across the Similkameen River from the open-pit, 16 kilometres south of Princeton. It is accessed via Highway #3 West.

The operation is owned by Newmont Mining Corporation, 200 Park Avenue, 36th Floor, New York, NY, 10166.

All of the known copper deposits lie in a 1,100 metre by 4,300 metre belt of Nicola volcanic rocks, bounded on the south by the composite Copper Mountain stock and on the north by the Lost Horse intrusive complex. It is believed that the Copper Mountain intrusions, the mineralization associated with them, and the volcanic rocks, are all of late Triassic age. Fluids producing alteration and mineralization came from the Lost Horse complex of porphyries and porphyry breccias. Alteration is intense, involving biotite, later pink feldspar, and scapolite. Mineralization of chalcopyrite and bornite is in fracture fillings and disseminations. Pegmatite veins, containing potash feldspar, biotite, and striking masses of bornite occur up to 2.3 metres thick.

This is a conventional open-pit mine. The ore is crushed at Copper Mountain then transported, via cable conveyor, over a suspension bridge to the concentrator. Copper concentrate is produced which is trucked to Vancouver for shipment.

References: *B.C. Ministry of Energy, Mines & Pet.Res.*, Bull. 59, Geology of Copper Mountain, British Columbia, 1972; Mining in British Columbia, Vol.1, 1975-1980, pp.28-29; Mining in British Columbia, 1981-1985, pp.22-23; *CIM*, Porphyry Deposits of the Canadian Cordillera, 1976, pp.368-375; MI 92H/SE-4.

SIMILKAMEEN (Newmont)

	1986	1987
Ore Shipped or Treated (t)	6,876,042	6,974,560
Product Shipped (t)		
Copper concentrates (t)	75,037	75,039
Gross Metal Content		
Gold (g)	419,679	448,668
Silver (g)	12,006,533	12,352,964
Copper (Kg)	23,664,723	23,803,935

SKEENA MINING DIVISION

CINOLA
(Fig.3, No.22)

Skeena M.D. Lat.53°32' Long.132°13' (103F/9E)

The property is located 18 kilometres south of Port Clements, B.C., on Graham Island in the Queen Charlotte Islands.

The operation is owned by City Resources (Canada) Ltd., Suite 2000, Park Place, 666 Burrard Street, Vancouver, B.C., V6C 2X8.

Low grade gold mineralization occurs within silicified pebble conglomerate, with interbedded sandstone and siltstone of Miocene age overlying a Cretaceous shale sequence. The gold is associated with a rhyolite dyke along the shale and conglomerate. The mineralization zone extends 300 metres vertically over an area of 1000 metres by 300 metres.

The property was acquired by Consolidated Cinola Mines Ltd. in 1977. In late 1986, City Resources (Canada) Ltd. took over control, and a feasibility study and diamond drilling program was commenced. In addition, an underground sampling program was undertaken in late 1986 and early 1987. Throughout 1987, studies were conducted to obtain the information needed for a Stage II Report for the MDRP.

The reserves are believed to contain a recoverable resource of approximately 1.7 million ounces.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.23; MI 103F-34.

PREMIER GOLD PROJECT
(Fig.3, No.23)

Skeena M.D. Lat.56°04' Long.130°02' (104B/1E)

The property is comprised of the Silbak Premier and Big Missouri mineslte, located 15 and 25 kilometres respectively north of Stewart, B.C., on the Granduc road.

The property is presently being developed by a consortium of companies led by Westmin Resources Ltd., Suite 1800, Bow Valley Square III, 255-5th Avenue S.W., Calgary, Alberta, T2P 3G6.

Two types of mineralization occur at the Silbak Premier site. The main type is related to the emplacement of a moderate to steeply dipping subvolcanic porphyritic dacite-Premier porphyry within host andesite of the Hazelton Group. The second occurs entirely within andesite as stratigraphically controlled zones, with sharp boundaries to wallrock alteration. The Big Missouri area is characterized by more than 16 zones of surface mineralization. These zones are located in three extensive stratigraphic horizons within andesitic volcanic rocks of the Hazelton Group.

Exploration work has been conducted at the Silbak Premier site since 1976, and at the Big Missouri site since 1979. Production is scheduled to commence at this gold/silver operation in early 1989 at a rate of 1995 tonnes/day. Mining will be by conventional open pit methods.

References: *B.C. Minister of Mines*, Ann. Report 1964, pp.21-22; *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.31; Mining in British Columbia, 1981-1985, p.25 (Silbak Premier); MI 104B-54.

SLOCAN MINING DIVISION

SILVANA (Silmonac)
(Fig.3, No.24)

Slocan M.D. Lat.49°58' Long.117°15' (82F/14W)

The property is located on the east bank of Tributary Creek, 1.6 kilometres west of Sandon, B.C. Access is via eight kilometres of paved highway and six kilometres of gravel road from New Denver, B.C.

The mine is owned by Dickenson Mines Ltd., 2600-130 Adelaide Street West, Toronto, Ontario, M5H 3P5.

The deposit lies in the main Slocan lode; the structure being mined occurs as a lode within a strong shear that cuts Slocan Group sedimentary rocks and dips at 20-30 degrees. The oreshoots vary in width from a few centimetres to three metres, and can be considerably altered by graphite shearing. Lead and zinc mineralization, with significant silver content, occurs in veins, pods and lenses and is mainly in the form of argentiferous galena and sphalerite.

This is an underground mine using a subdrifter slash room and pillar method. Lead and zinc concentrates are produced and hauled to the smelter in Trail. After ceasing operations in December, 1983, the mine has been in back in production since September, 1984, with the concentrator operating at capacity in 1986. During 1986 and 1987, an underground exploration program continued to increase ore reserves, extending the life of the mine into 1989.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, pp.36-37; Mining in British Columbia, 1981-1985, p.27; MI 82F/NW-50.

SILVANA (Silmonac)

	1986	1987
Ore Shipped or Treated (t)	21,929	25,653
Product Shipped (t)		
Lead concentrates (t)	2,821	3,113
Zinc concentrates	2,811	2,614
Gross Metal Content		
Silver (g)	14,865,629	15,320,111
Lead (Kg)	2,103,701	2,340,634
Zinc (Kg)	1,508,152	1,406,769

METAL MINES THAT CEASED PRODUCTION DURING 1981-1985 PERIOD

The following is a list of metal mines which were described in Mining in British Columbia, 1981-1985, but which are not now active producers.

Ashlu Gold Mine - During 1986, an economic evaluation for an exploration program was carried out; however, the program was not initiated. In 1987, there was legal wrangling regarding ownership of the property and no work was carried out.

Aufeas Gold - During 1986 and 1987, test drilling was carried out along with some bulk sampling.

Baker Mine (Chappelle) - The operation closed in October, 1983.

Bethlehem - Operations were shut down in June, 1982, due to economic conditions.

Boss Mountain - Because of depressed market conditions the company ceased mining and milling in March, 1983. Activities during 1986 and 1987 concentrated on the removal of all mining equipment and buildings, and the work of final reclamation.

Bralorne - Production at the mine ceased in 1971 and in March, 1982, the mine was put on a care and maintenance basis. During 1986 and 1987, the mine remained on care and maintenance.

Carolin - In 1985, the operation was placed on a care and maintenance basis. In November, 1986, the property forfeited to the Crown as a result of unpaid property taxes totalling approximately $1.9 million.

Free Gold (Dome Mountain) - This property was idle in 1986. A drilling program was conducted by Total Erickson in late 1987.

Chaput - No work has been done since 1981.

French Mine - Work ceased in August, 1983. Exploration drilling is continuing on the property.

Goldstream Mine - The operation closed in April, 1984, due to depressed metal markets.

Granduc Mine - Production ceased in April, 1984 due to low copper prices. Salvage, demolition, and reclamation of the mine and plant was completed in October, 1984.

Granisle - The mine completely ceased operations in 1982, and was closed in 1985. The open-pit is said to still contain reserves, however the surface facilities are for sale and an abandonment plan is in progress.

Hewitt - There has been no work done since the mine was sealed off in 1981.

Highmont - This operation shut down in October, 1984, for economic reasons. The operation has remained closed, with only maintenance and security work being performed during 1986-87.

Horn Silver - Mine operations ceased on October 31, 1984; however, milling was carried out intermittently from 1982 to 1985, with ore being milled on a custom basis.

Kelly Creek - There has been no work on this property since 1981. The claims have been allowed to lapse and some have been restaked.

Kitsault Mine - In 1982 the mine experienced production cutbacks, and operations were suspended in November. The mine remained inactive, and in November, 1983, the townsite was closed and maintenance of the access road halted.

Lornex - In 1986, the Lornex mine operation was merged with Cominco's Valley Copper mine operations to create Highland Valley Copper.

OK (Alwin) - All operations ceased in September, 1981, due to continued operating losses attributed to high mining costs and low metal prices.

Ruth Vermont - Operations ceased on December 15, 1981, due to low metal prices and a lack of working capital. Apart from some clean-up at the mill, no work has been done on the property since.

SAB Mine (Monashee) - The operation was shut down on November 30, 1982.

Scottie Gold Mine (Summit Lake) - The mine was closed down in February, 1985, and put on a care and maintenance basis.

Silver Standard - This small underground mine was inactive during 1986-1987.

Tasu Mine - Mining operations ceased permanently on October 5, 1983, due to the exhaustion of economic reserves.

Tetra (Armagh) - The mill froze up at the end of 1981 and was not reactivated.

Utica - Mining operations ceased permanently on October 5, 1983, due to the exhaustion of economic reserves.

Valley Copper - In 1986, the Valley Copper mine operation was merged with the Lornex mine operation to create Highland Valley Copper.

Warman (Brandywine) - operations were suspended in July, 1982, due to economic conditions.

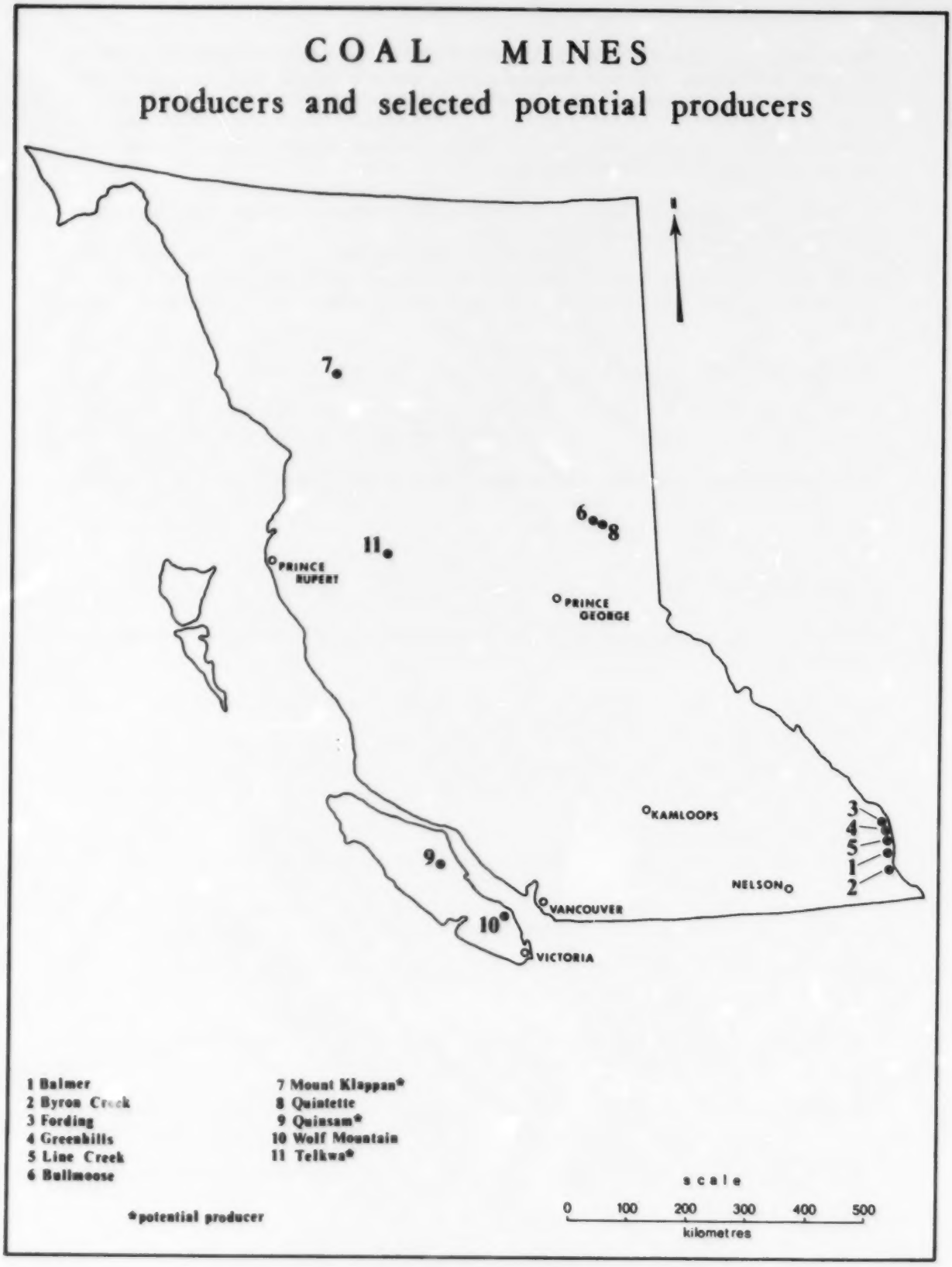

COAL MINES
producers and selected potential producers
N
7
6
8
11
PRINCE RUPERT
PRINCE GEORGE
KAMLOOPS
3
4
5
1
2
9
NELSON
VANCOUVER
10
VICTORIA
1 Balmer
2 Byron Creek
3 Fording
4 Greenhills
5 Line Creek
6 Bullmoose
7 Mount Klappan*
8 Quintette
9 Quinsam*
10 Wolf Mountain
11 Telkwa*
*potential producer
scale
0 100 200 300 400 500
kilometres

Figure 4

FORT STEELE MINING DIVISION

BALMER
(Fig.4, No.1)

Fort Steele M.D. Lat.49°45' Long.114°45' (82G/16W)

The mining operations are located on Harmer Ridge, five kilometres southeast of Sparwood, B.C. The preparation plant is located in the Elk Valley, three kilometres from Sparwood.

The mine is owned by Westar Mining Ltd., 1900-1176 West Georgia Street, Vancouver, B.C., V6E 4B9.

The Balmer operations are located on a syncline at the north end of the Fernie Basin. The area is underlain by the Kootenay Formation which is a series of interbedded sandstones, mudstones, siltstones, shales, conglomerates and coal seams up to 665 metres in thickness. In the area of the mine up to 18 metallurgical coal seams are evident. The seams generally dip at 15–20° and are disturbed by numerous thrust faults.

Mining is by open-pit truck and shovel methods on 15 metre benches. After treatment in the Elkview preparation plant, the coal is hauled to the Roberts Bank terminal from where it is shipped to export markets. In 1986, modifications were made to the preparation plant, and a high energy scrubber was installed to reduce particulate emissions. There was a four month work stoppage from May to October, 1986, due to labor disputes.

In 1987, a 3.5 kilometre long in-pit raw coal conveyor complete with a new truck dump/feeder facility was constructed, and the tailings-impoundment capacity was increased. There was a six-week shutdown to control inventories.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.51; Mining in British Columbia, 1981-1985, p.74; Coal in British Columbia, Paper 1986-3, p.25; MI 82G/NE-11,13,14,16,23.

BALMER

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	79,946	3,483,414	3,563,360
1987	1,325,841	3,734,298	5,060,139
Total	1,405,787	7,217,712	8,623,499

BYRON CREEK
(Fig.4, No.2)

Fort Steele M.D. Lat.49°30' Long.114°40' (82G/10E)

Located 30 kilometres east of Fernie, B.C., on Coal Mountain, the property extends approximately five kilometres south of the old townsite of Corbin. Access is via 25 kilometres of gravel road south from Highway 3.

Byron Creek Collieries Limited is a wholly-owned subsidiary of Esso Resources Canada Ltd., Esso Plaza, 237-4th Avenue SW, Calgary, Alberta, T2P 0H6.

The Coal Mountain operations are located on the eastern edge of the Crowsnest Coalfield. Coal Mountain comprises complex folded and faulted Jura-Cretaceous sedimentary rocks. The one coal seam being mined averages about 30 metres in thickness, and is ranked medium volatile bituminous by ASTM standards.

This is an open-pit mine producing thermal and weak coking coal. The raw coal is crushed in a rotary breaker, cleaned and dried, then loaded on to rail cars at the loadout facility. Several projects that had been initiated in September, 1985, were completed by June, 1986. These included a preparation plant and thermal drier, refuse and sample buildings, a heavy equipment maintenance shop and warehouse, and a sedimentation pond.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.50; Mining in British Columbia, 1981-1985, p.71; Coal in British Columbia, Paper 1986-3, p.26; MI 82G/NE-1.

BYRON CREEK

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	874,827	-	874,827
1987	614,672	177,454	792,126
Total	1,489,499	177,454	1,666,953

FORDING
(Fig.4, No.3)

Fort Steele M.D. Lat.50°11' Long.114°52' (82J/2W)

The property lies in the upper Fording River Valley, 68 kilometres north of Sparwood. Access is via 30 kilometres of paved road northeast of Elkford, B.C.

Fording Coal Limited is owned by Canadian Pacific Limited, 200-205 9th Avenue SE, Calgary, Alberta, T2G 0R4.

The property is in the northern section of the Elk Valley coalfield in the Fording River Valley. The seams are contained within the coal-bearing Kootenay Group and are found in two distinct blocks of coal-bearing strata. West of the Fording River is the Greenhills area with a syncline plunging to the north as it traverses the Greenhills Mountain Range. On the east side is a second syncline, lying at a much higher elevation, which also plunges to the north and is well faulted in the Eagle Mountain and Brownie Ridge areas.

The mine operates on both sides of the Fording River with the office, maintenance site and preparation plants located on the east side at the base of Eagle Mountain. The mine is open-pit, involving multi-seam truck and shovel operations and one dragline. The coal is shipped by rail to both domestic and export markets. Construction work was carried out on the South Tailings Pond in 1986-87.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.51; Mining in British Columbia, 1981-1985, p.73; Coal in British Columbia, Paper 1986-3, p.24; MI 82J/SE-9, 12.

FORDING

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	492,816	4,627,363	5,120,179
1987	837,617	5,081,895	5,919,512
Total	1,330,433	9,709,258	11,039,691

GREENHILLS
(Fig.4, No.4)

Fort Steele M.D. Lat.50°06' Long.114°52' (82J/2W)

The mine is located 40 kilometres north of Sparwood, B.C., and 10 kilometres northeast of Elkford, B.C., in the upper Elk Valley. Access is via road from Elkford.

The operations are owned by Westar Mining Ltd., 1900-1176 West Georgia Street, Vancouver, B.C., V6E 4B9.

The property is nearly midway along the Elk Basin, which is the northern section of the Crowsnest Coalfield. The seams are contained in the coal-bearing member of the Kootenay formation within an elongate synclinal formation trending north-northwest. Numerous small-scale normal and thrust faults complicate mining on the east limb and axis of the syncline. Twenty-nine seams are known to exist; however only a few are economic to mine. The coals are of medium-volatile bituminous rank, and of high-volatile A bituminous rank.

The Greenhills operation is an open-pit multi-seam coal mine using conventional truck and shovel methods. Two main end products are produced for the export market: high quality metallurgical coal and raw thermal coal at about 15% ash. These products are shipped via the terminal at Roberts Bank.

The operation was shut down for a total of 22 days throughout January to April, 1986, for inventory reduction. It was then closed from April 6-May 28, 1986, due to a lock-out followed by a strike. Modifications were made to the sediment impoundments and the preparation plant in 1986-87. In 1987, Stage 1 approval was received for the Falcon pit development, and stripping of rock began in September. A total of 1.7 million tonnes of 1-seam coal is scheduled to be removed over a three-year period.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.51; Mining in British Columbia, 1981-1985, pp.74-75; Coal in British Columbia, Paper 1986-3, p.24; MI 82J/SE-7.

GREENHILLS

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	741,220	1,694,393	2,435,613
1987	872,975	2,255,121	3,128,096
Total	1,614,195	3,949,514	5,563,709

LINE CREEK
(Fig.4, No.5)

Fort Steele M.D. Lat.49°55' Long.114°46' (82G/15W)

The Line Creek Mine site is located in the Crowsnest Pass area, approximately 24 kilometres northeast of Sparwood, B.C. and 14 kilometres southeast of Elkford, B.C. The plant site, located adjacent to the C.P. railway spur-line to Fording Coal, is situated 9 kilometres downstream from the mine. Access is via an eastern lateral from Highway 4, midway between Sparwood and Elkford.

Crows Nest Resources Limited, P.O. Box 2003, Sparwood, B.C., is owned by Shell Canada Limited, 400-4th Avenue SW, Calgary, Alberta, T2P 0J4.

The Line Creek property is situated on the west limb of the Alexander Creek syncline, near the south end of the Elk Valley Coalfield. The coal lies in the Kootenay Formation and is deposited in ten seams, of which seven are being mined in the current pit. These seven seams are thicker than 2.8 metres and have an aggregate thickness of up to 55 metres. Ninety percent of the reserves are in the four lower seams. The seams range from low- to medium-volatile bituminous in rank.

This is an open-pit mine, mining 12m benches using conventional truck and shovel methods. Production began in 1982, with the metallurgical plant coming on stream in 1983. During 1986, operations were shut down for three brief periods to avoid over-production in relation to sales. In 1987, production began from the Lower South pit adjacent to the main pit.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Coal in British Columbia, Paper 1986-3, p.25; Mining in British Columbia, 1981-1985, p.72; MI 82G/NE-20

LINE CREEK

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	n/a	n/a*	1,700,000
1987	567,815	1,152,065	1,719,880
Total			3,419,880

* not available

LIARD MINING DIVISION

BULLMOOSE
(Fig.4, No.6)

Liard M.D. Lat.55°06' Long.121°30' (93P/3W)

The Bullmoose mine is located 87 kilometres south of Chetwynd, B.C., and 40 kilometres northwest of Tumbler Ridge, B.C. It is accessed by following Highway 29 to Kilometre 71, then west along Bullmoose Creek for 18.5 kilometres.

The managing partner and operator of Bullmoose Mine is Teck Corporation, 1199 West Hastings Street, Vancouver, B.C., V6E 2K5.

In two areas on the Bullmoose property the lower part of the Gates Formation occurs at shallow depth and with gentle dips; the northern portion is the "West Fork" area and the southern portion is the "South Fork" area. The West Fork area lies along the axial portion of a broad syncline and strata are generally flat lying for about two kilometres along the structure. In the South Fork area, the lower Gates strata form a platter-shaped outlier which dips gently to the north and is crudely concordant with the slope. Erosion has exposed coal seams around the entire periphery of the South Fork area, and along the southern edge of the West Fork area. Five mineable seams have been identified that range from less than a metre to five metres in thickness, and have an aggregate thickness of approximately 12 metres.

This is a conventional truck and shovel operation. Coal is loaded into haul trucks and transported to the truck conveyor dump and into a Bradford breaker. From there the coal goes to the raw coal silo, and thence to the coal preparation plant. After washing and drying, the coal is transported by truck to rail load-out silos, and is then hauled by unit train to Prince Rupert. The mine began commercial production began in November, 1983, and was officially opened in June, 1984. In 1986, a new bridge was built over Bullmoose Creek to access the plantsite, following the collapse of the old bridge.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.75-76; Coal in British Columbia, Paper 1986-3, p.20; MI 93P-1,12,16.

BULLMOOSE

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	69,618	2,098,000	2,167,618
1987	-	1,700,168	1,700,168
Total	69,618	3,798,168	3,867,786

MOUNT KLAPPAN
(Fig.4, No.7)

Liard M.D. Lat.57°15' Long.128°45' (104H/2W)

The Mount Klappan coal property is located 150 kilometres northeast of Stewart, B.C. Access to the property is gained by following Highway 37 north from the Meziadin junction to the Ealue Lake turnoff, 17 kilometres south of Iskut. The property is then accessed by following the railway grade for 140 kilometres.

The Mount Klappan anthracite project is controlled by the Coal Division of Gulf Canada Resources Inc., 401-9th Avenue S.W., Calgary, Alberta, T2P 2H7.

The Mount Klappan property is located on the Groundhog coal deposits in the Skeena Mountains. The structure at Mount Klappan shows open to tight folds that are almost vertical or are overturned to the northeast. The whole area is cut by younger high-angle faults trending northwest, north or northeast. The coal measures have a minimum thickness of 350 metres and consist of conglomerate, sandstone, mudstone, marl and coal seams. The coal seams occur in three units - the Lower, Middle, and Upper units - and are ranked as anthracite.

The project is an open-pit trial excavation. During 1984-85, the project saw further exploration, the construction of an access road, and the development of the open-pit and surface facilities. Gulf Canada Resources submitted a Stage II report in early 1987; however, by year end the review by the Mine Development Steering Committee was incomplete. No market arrangements for this product have been announced.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.76-77; Coal in British Columbia, Paper 1986-3, p.31; MI 104H-20,21.

QUINTETTE
(Fig.4, No.8)

Liard M.D. Lat.55°01' Long.121°13' (93I/15W)

The mine site is located 120 kilometres south of Chetwynd, B.C., and 12 kilometres west of Tumbler Ridge, B.C. It is accessed either by Highway 29, or by the Heritage Highway through Tumbler Ridge, to the Quintette plant site.

The managing partner and operator of the mine is Denison Mines Ltd., P.O. Box 11575, 650 West Georgia Street, Vancouver, B.C., V6B 4N7.

The Gates Formation and the Gething Formation both contain coal seams of mineable thickness on the Quintette property; however, the Gates Formation contains all the reserves. Underlying the Babcock Mountain area is an extensive area of gently dipping seams bounded by dipping limbs. Six seams are of mineable thickness and two pits have been delineated: the Babcock pit on the eastern slope of Babcock Mountain; and the Roman pit, located within a fairly simple chevron fold at the southern end of the Murray syncline. North of the Murray River, in the Wolverine area, two more pits have been delineated. The Mesa pit, which is located on Mast Ridge, is contained in a complex syncline overlying a large thrust fault. The Deputy pit is situated in a smaller syncline immediately to the southwest and is contiguous with the Mesa pit. The Mast syncline, an area of relatively minor faulting, is located further to the southwest of the Mesa pit and contains the Wolverine pit.

This is a conventional truck and shovel operation for both waste removal and coal recovery. The mine began production at the Mesa pit in 1983, and the Wolverine pit came into production in 1985. Both of these pits were in production during 1986-1987.

Pioneering and development of a third open-pit, the Shikano pit, began in September, 1986. Commercial production at this pit began in August, 1987; it will provide 20% of annual deliveries. Major waste dump failures occurred in both 1986 and 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.77-78; Coal in British Columbia, Paper 1986-3, p.21; MI 93I/10,11, MI 93P/19,20.

QUINTETTE

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	105,055	5,201,422	5,306,477
1987	9,037	4,452,252	4,461,289
Total	114,092	9,653,674	9,767,766

NANAIMO MINING DIVISION

QUINSAM
(Fig.4, No.9)

Nanaimo M.D. Lat.49°50' Long.125°18' (92F)

This operation is located 30 kilometres southwest of Campbell River, B.C.

The mine is owned by Brinco Coal Corp., 1480-1055 West Hastings Street, Vancouver, B.C., V6E 2E9.

The Quinsam coal measures are an erosional outlier of the Comox Formation, part of the Nanaimo Group. Coal measures are bounded and underlain by basement rocks of Triassic and Jurassic age. Coal is found in the Cumberland and Dunsmuir members of the Comox Formation, with siltstone, mudstone and sandstone. Major coal seams are the Quinsam No.1 and No.2 beds in the Cumberland member, which are well exposed in the Quinsam mine highwall, and the Quinsam No.3 and No.4 beds in the Dumsmuir member. Coal bed No.1 is being mined. It is located north of Middle Quinsam Lake and ranges from 3.3 to 4.2 metres in thickness.

Exploration of the coal reserves commenced in 1976. Bulk sampling operations commenced in September, 1985 and continued on an intermittent basis until the end of 1986. During 1986, the mine site was developed and a total of 11,000 tonnes of coal was mined.

On May 1, 1987, Brinco Coal bought out its joint venture partner and acquired all coal rights at the mine. In 1987, mine and reclamation plan approvals as well as environmental permits were granted, allowing Brinco to operate a surface coal mine with a capacity of up to one million tonnes/year. A settling pond dam was constructed and stripping of a 50,000 tonne bulk sampling pit was initiated. By year end, a series of significant bulk test shipments was being planned.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Coal in British Columbia, Paper 1986-3, p.30; MI 092F-319

WOLF MOUNTAIN
(Fig.4, No.10)

Nanaimo M.D. Lat.49°07' Long.124°01' (92F/1E)

The property is located on Vancouver Island approximately 10 kilometres southwest of Nanaimo, midway between Mount Benson and the Nanaimo River.

Wolf Mountain Coal Limited is owned and operated by Wolf Mountain General Limited Partnership, 5240 Gulf Place, West Vancouver, B.C., V7W 2V9.

The geological structure of the property is that of an asymmetrical syncline. The axis of the syncline plunges gently to the east, the southern limb being generally shallow and the northern limb steeper. The coal seam considered to be of economic interest is correlated with the Wellington seam and is of variable thickness.

The mine is worked by the room and pillar system, using a continuous miner and shuttle car. A conveyor belt transports the coal to the surface, then it is taken in 15-tonne trucks to a central depot where it is screened to remove some of the waste.

The mine closed down in December, 1986, due to the lack of markets. It remained closed in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.78; MI 92F-322.

WOLF MOUNTAIN

Year	Clean Coal Production (tonnes) Thermal	Metallurgical	Total
1986	20,000	-	20,000
1987	-	-	-
Total	20,000	-	20,000

OMINECA MINING DIVISION

TELKWA
(Fig.4, No.11)

Omineca M.D. Lat.54°35' Long.127°10' (93L/11E)

The Telkwa property is located approximately 10 kilometres southwest of the village of Telkwa, B.C., adjacent to Goathorn Creek.

Crows Nest Resources Limited (Telkwa Prospect), c/o Box 100, Calgary, Alberta, T2P 2H5, is owned by Shell Canada Resources Limited.

The coal measures of the Telkwa basin occur within the Skeena Group which is of Cretaceous age. These coal measures dip to the northeast or east, generally average 400 metres in thickness, and consist of three stratigraphic units. The coal seams are found in the upper zone of the lower unit and the lower zone of the upper unit. The coal ranges from medium- to high-volatile bituminous in rank.

Approval-in-principle was granted to Crowsnest Resources for the development of the Telkwa coal deposits, however, poor market conditions have delayed this development.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.79; Coal in British Columbia, Paper 1986-3, p.31; MI 93L/152,155,156.

ASBESTOS

Reported occurrences of asbestos in British Columbia are mainly in serpentinites. In addition to the one producing mine at Cassiar, there are several undeveloped deposits which include a lower-grade deposit at Kutcho Creek, and four large but low grade occurrences in the southern part of the province (Sproat Mountain, Moon Creek, J, and Ace).

1. CASSIAR

Liard M.D. Lat. 59°20' Long.129°49' (104P/5W)

The mine is located on Mount McDame, approximately 4.8 kilometres north of Cassiar, B.C. The plant site is nine kilometres from Highway 37, approximately 120 kilometres north of Dease Lake.

The property is owned by Cassiar Mining Corporation, 2000-1055 West Hastings Street, Vancouver, B.C. V6E 3V3.

The orebody is in a sill-like mass of serpentinite, intrusive into Devonian-Mississipian sedimentary rocks. The orebody strikes north and dips 30-40° to the east. Numerous veinlets of chrysotile asbestos occur in light to dark green serpentinite. Magnetite is fairly abundant, occurring in disseminated microscopic veinlets and larger aggregates. Other associated minerals include magnesite, brucite, and antigorite. On the hanging-wall, zones of zoisite-quartz-tremolite hornfels occur at the contact of serpentinite with argilites and contain local, irregular bodies of nephrite jade.

This open pit mine commenced operations in 1953; the present open pit orebody will sustain operations until the beginning of 1991. The mine uses truck and shovel methods, and is capable of producing in excess of 100,000 tonnes of high quality chrysotile asbestos fibre per year. The fibre is packaged, transported by road to the dock at Stewart, B.C., then barged to Vancouver, B.C. Sales are made to customers in 45 countries around the world.

The mine was closed from July 1, 1986 to September 30, 1986 to reduce inventory, as markets and prices continued to be depressed. However, sales increased in 1987 allowing a planned two month summer shutdown to be reduced to five weeks.

During 1985, a major underground exploration program was initiated to study the McDame orebody, located south of the existing open pit. In 1986 and 1987, the focus was on the evaluation and advancement of McDame. A feasibility study was conducted, and development commenced in 1987. Production is planned to begin in mid-1990. The new mine will use the existing mill, town site and transportation facilities.

Construction of a wet milling pilot facility began in December, 1987. This facility is expected to improve recovery of fibre from existing operations, as well as provide a method of treating stockpiled tailings.

Total fibre production was 80,676 tonnes in 1986 and 96,014 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol. 1, 1975-1980, p.41; Mining in British Columbia, 1981-1985, p.52; MI 104P-5.

BARITE

Barite production was depressed during this period due to low demand by the oil and gas drilling industry.

2. BAR-WELL RESOURCES

Golden M.D. Lat.50°40' Long.116° (82J/K)

The property is located in the Windermere area of the east Kootenays, near Invermere, B.C.

The operation is owned by Dynamic Drilling Fluids, 230-1110 8th Avenue S.W., Calgary, Alberta, T2P 1J2.

During the winter of 1986-1987, a new drift was opened at the incline of the main zone. The working plan is to produce 5000 tonnes of drilling grade barite; however, the operation is presently shut-down pending improved market conditions.

3. BRISCO

Golden M.D. Lat.50°49' Long.116°19' (82K/16W)

The Brisco mine is located four kilometres west of the hamlet of Brisco, B.C., at an elevation of 990 metres.

The property is owned by Mountain Minerals Company Limited, Box 700, Lethbridge, Alberta., T1J 3Z6.

This is an underground mine using room and pillar methods. Operations were suspended from January-March, 1986, and again in November and December, 1986, due to economic reasons. In 1986, a decline to the 3060 level was completed. During the operating periods, barite was mined at approximately 50 tonnes/day in 1986 and 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol. 1, 1975-1980, p.42; Mining in British Columbia, 1981-1985, p.54; MI 82K/NE-13.

4. FIRESIDE BARITE

Liard M.D. Lat.59°46' Long.127°12' (94M/14E)

The Fireside mine is located at kilometre 887 north on Highway 97. A 4.5 kilometre access road on the north side of Highway 97 leads into the property.

The property is owned by the Magcobar Minerals Division of Dresser Industries Inc., P.O. Box 6504, Houston, Texas, U.S.A. 77005.

This open pit mine began operating in 1984 and was in full production by 1985, producing 41,071 tonnes of barite. However, the operation was inactive in both 1986 and 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.53; MI 94M-3.

5. PARSON

Golden M.D. Lat 51°01' Long. 116°39' (82N/2E)

The property is located seven kilometres southwest of Parson, B.C., at an elevation of 1,200 metres. It is accessed by crossing the Columbia River from Parson and following the Crestbrook forest road.

The mine is owned by Mountain Minerals Limited, Box 700, Lethbridge, Alberta., T1J 3Z6.

Two sub-parallel fissure veins, about 100 metres apart and dipping 55 degrees west, are in Lower Cambrian sedimentary rocks.

This is an underground mine using a room and pillar method. Barite ore is produced and shipped to Mountain Minerals' grinding plant in Lethbridge, Alberta. After being closed in 1981-82, the mine was reactivated in 1983, operating on a reduced scale. Due to a lack of demand, the mine was shut down from September 1, 1986 to January 4, 1987. A crushing and jigging facility was constructed between May and July, 1987, and operated from September to November, 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol. 1, 1975-1980, p.42; Mining in British Columbia, 1981-1985, p.53; MI 82N-2.

6. SILVER GIANT

Golden M.D. Lat.50°56' Long.116°28' (82K/16W)

The old Silver Giant lead-zinc mine is located on the west slope of Jubilee Mountain, on the northeast side of Spillimacheen River.

This property is owned and operated by Baroid of Canada Ltd. P.O. Box 250, Onoway, Alberta, T2P 0T9.

Silver Giant Mine is a barite replacement orebody in Cambrian limestone. The operation has been inactive since 1985.

Reference: MI 82K/NE-18.

BUILDING STONE

In the past, quarries scattered along the coast and in the southern part of the Province provided a wide variety of dimension stone applied in many old buildings.

Pink and white spotted granite from Beaverdell, pink granite from Vernon, light grey granodiorite from Nelson, and grey granodiorite from Nelson Island were at one time popular building materials. Several local materials can still be seen in buildings in Nanaimo, Vancouver, and Victoria including: black monzonite from Rossland; brown pulaskite with bluish iridescent feldspars from Ymir; bright grey andesite from Haddington Island; and streaky grey marble from Kootenay Lake and Tahsis Inlet. The Cretaceous sandstone from many quarries on Vancouver Island, as well as on several of the Gulf Islands, was used in many old buildings.

Recently, building stone for flagstone and facing stock has been produced from quartzite in the Salmo area, and from a mica-schist from Revelstoke. A deposit of green slate at Dome Creek, near McBride, has been examined since 1986 for roofing and flagstone applications.

7. DOMINION CREEK (Beaverdell)

Greenwood M.D. Lat.49°20' Long.119°03' (82E/6E)

This property is located on Highway 33 at Dominion Creek, 13 kilometres south of Beaverdell, B.C.

It is operated by APS Architectural Precast Structures Ltd., Langley, B.C.

The stone is coarse-grained and porphyritic, with phenocrysts of pink orthoclase feldspar.

The quarry is only used on an as-required, intermittent basis. The granite is used for ornamental architectural purposes in precast concrete aggregate blocks and as sheets for outside facing.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, British Columbia Dimension Stone, IC 1988-6, p.9.

8. KNIGHT INLET

Vancouver M.D. Lat.51° Long.126° (92K/12W)

The quarry is located approximately 250 kilometres northwest of Vancouver on the north shore of Knight Inlet.

The quarry is owned by Ranex Industries (the successor company of Kellard Marble Inc.), 2040 W. 12th Avenue, Vancouver, B.C., V6J 2G2.

The stone is medium-grained with an attractive blue-grey colour, darkened by well-shaped crystals of hornblende and black mica. Reserves of 62,500 m^3 of fresh, unaltered "granite" are reported.

The quarry has operated intermittently since 1985, producing monumental and ornamental stone known as "Catherine Blue Granite".

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, British Columbia Dimension Stone, IC 1988-6, p.17.

9. PITT RIVER

New Westminster M.D.Lat.49°17' Long.122°40' (92G/7E)

The quarry is located on Sherridan Hill, on the east bank of the Pitt River. It is operated by Pitt River Quarries Ltd., 2300 Rodgers Avenue, Coquitlam, B.C., V3K 5X6.

Open-pit bench mining methods are used to produce quartz diorite rip-rap. Undersized rip-rap is crushed and screened to produce marketable products, which are shipped by scow along the Pitt River to markets in the Lower Mainland, and eastern Vancouver Island. The quarry operated intermittently throughout the 1986 to 1987 period.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.56; MI 92G/SE-7.

10. REVELSTOKE FLAGSTONE

Revelstoke M.D. Lat.50°56' Long.118°12' (82L/16E)

This property is located on Begbie Road in Revelstoke, B.C.

The operation is owned and operated by A. McKenzie, Box 397, Revelstoke, B.C.

This small, one-man enterprise was started in 1957 and operates in the summers only. Drilling and blasting is done to loosen the slabs, followed by hand splitting. The stone is a light grey muscovite mica-schist which is supplied to building material companies in B.C. and Alberta. Production of saleable product was 145 tonnes in 1986, and 247 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, British Columbia Dimension Stone, IC 1988-6, p. 26.

11. SALMO QUARTZITE

Nelson M.D. Lat.49° Long.117° (82F)

The operation is owned by the Kootenay Stone Centre, Box 486, Salmo, B.C., V0G 1Z0.

Several types of quartzite are produced from quarries situated from Sheep Creek in the south to Duncan Lake in the north. The stone is used for flagging and outside facing.

References: *B.C. Ministry of Energy, Mines & Pet Res.*, British Columbia Dimension Stone, IC 1988-6, p.26.

12. SIRDAR GRANITE

Nelson M.D. Lat.49°16' Long.116°36' (82F)

This property is located approximately 22 kilometres north of Creston, B.C., on Highway 3A.

The operations are owned by International Marble and Stone Company Ltd. (IMASCO), 19287-98A Avenue, Surrey, B.C., V3T 4W2.

A small quantity of granite is quarried to produce granules, poultry grit and similar products. The IMASCO processing plant is on the quarry site. This crushing and grinding plant is operated on a year-round basis, with most production being dolomite from Crawford Bay and calcium carbonate from Lost Creek. Plant production averages approximately 60,000 tonnes/year.

In addition, four quarries operate on an intermittent basis to produce railroad ballast: C.P.R. operates the Walhachin quarry between Cache Creek and Kamloops, B.C.; C.N.R. operates the McAbbee quarry in the Walhachin area and the Giscome quarry on the west side of Eaglet Lake, east of Prince George, B.C.; and B.C.R. operates the Summit Lake quarry north of Prince George.

CARBONATITES

Cominco Ltd. continued exploration of the Aley deposit in 1986, and reported significant niobium values. Rare earth minerals are reported from this property, but no commercial accumulations have been identified to-date.

CLAY AND SHALE

The bulk of brick and tile products used in British Columbia come from Alberta or Washington State. While fireclay has been reported from Glacome Rapids and stoneware clay from the Quesnel, Prince George, and Coal River areas, the ceramic clay potential of Cretaceous-Tertiary basins in British Columbia is poorly known.

13. DUNSMUIR SHALE

Nanaimo M.D. Lat.48° Long.124° (92G)

The property is located near Nanaimo on Vancouver Island, B.C.

The operation is owned by Dunsmuir Quarries Ltd., 1505-1181 88th Avenue, Delta, B.C., V4C 8A2.

The site contains black shale which is mainly used in the manufacture of cement.

The quarry worked on an intermittent basis during 1986-1987 as orders were received. In 1986, a total of 170,000 tonnes was mined, of which 152,000 tonnes was shipped from Breckin Point near Nanaimo to Vancouver. In 1987, 132,000 tonnes was mined, all of which was shipped to Vancouver.

14. FIRE CLAY

New Westminster M.D. Lat.49°03 Long.122°17 (92G/1E/1W)

The property is located at Sumas Mountain, near Kilgard, B.C.

It is operated by Clayburn Industries Ltd., Railway and Pine, Abbotsford, B.C., V2S 5C1.

The mine is located in a small Eocene outlier that consists of a sequence up to 400 metres thick of alternating beds of claystones, siltstones and conglomerates. Several shale beds have been mined over the years, exhibiting a variety of fired colours ranging from buff-pink grey to deep red. A layer of fire clay three to four metres thick occurs at the base of the sequence, and exhibits pinkish white to light buff colour.

The operation includes an underground mine and two open pits. Underground mining uses room and pillar methods on a single level and the open pits are worked on a bench system. The mine produces fire clay, shale and sandstone. Clay and shale are trucked to the Abbotsford plant and either precalcined or used in brick manufacturing; some sandstone is used in cement manufacturing.

The company continued production during 1986 and 1987 with no major changes.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Bull.30, Clay and Shale Deposits of British Columbia; Mining in British Columbia, Vol. 1, 1975-1980, p.43; Mining in British Columbia, 1981-1985, pp.56-57; MI 92G/SE-4, 5, 31.

15. STRAITON (SUMAS)

New Westminster M.D. Lat.49°06' Long.122°08' (92G/1E)

This quarry is located on Sumas Mountain, near Kilgard, B.C.

It is owned by Canada Cement Lafarge Ltd., 1051 Main Street, Vancouver, B.C., V9A 2V9, and is operated by Toews Bros. Bulldozing of Abbotsford.

Thin sandstone and shale are bedded in near-horizontal layers from three to ten metres thick. The quarry is worked using a bench system, with bench heights of seven metres. Sandstone is drilled and blasted, and shale layers are ripped using bulldozers. Both products are trucked to an in-pit jaw crusher. The product is cement quality shale and sandstone for the Lafarge cement plant in Richmond, B.C.

During 1986 approximately 5500 tonnes of shale was extracted. In 1987, extraction of shale occurred on an intermittent basis.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, p.57; MI 92G/SE-24.

DIAMONDS

Dia Met Minerals Ltd. of Kelowna drilled the Jack diatreme north of Golden, B.C. A microdiamond was reported from this property in 1985.

DIATOMITE

There are many diatomite occurrences in British Columbia. The diatomite beds consist almost exclusively of Melosira granulata diatoms. These are usually very small and are mixed with variable amounts of clay, silt and devitrified volcanic ash.

Clayburn Industries Ltd. operated a pit at the Quesnel deposit. The product is used in lightweight insulation bricks. The Red Lake deposit (MI 92I/NE-81) near Kamloops, B.C. was operated in 1986 to produce industrial and domestic absorbents. The operation was closed in 1987, but the operator, Western Industrial Clay Products of Kamloops, plans to resume operations in 1989.

DOLOMITE

16. CRAWFORD BAY

Nelson M.D. Lat.49°41' Long.116°47' (82F)

The quarry is located approximately 80 kilometres north of Creston, B.C., 3.2 kilometres from Highway 3A.

The quarry is owned by International Marble and Stone Company Ltd. (IMASCO), 19287-98A Avenue, Surrey, B.C., V3T 4W2.

This is an underground operation, using room and pillar methods, that has marketed several grades of pulverized dolomite. The white dolomitic limestone is processed into a variety of crushed and ground products including stucco dash, granules, soil conditioners and landscaping chips at the IMASCO plant at Sirdar,B.C.

Production was approximately 30,803 tonnes in 1986 and 40-50,000 tonnes in 1987.

17. ROCK CREEK

Greenwood M.D. Lat.49° Long.119° (82E)

This property is located approximately 40 kilometres east of Osoyoos, B.C.

The operator is Mighty White Dolomite, P.O. Box 10, Rock Creek, B.C., V0H 1Y0.

A small body of crystalline carbonate rock is mined to produce ground dolomite for use as a soil conditioner, and white rock chips of varied size for landscaping and decorative purposes.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, P.58.

FELDSPAR

Following CAMROC'S unsuccessful attempt to develop a feldspar deposit near Boston Bar in 1985, Bearcat Explorations Ltd. is re-evaluating its beryllium prospect at Hellroaring Creek near Kimberley, B.C., as a feldspar deposit. Bulk sampling and mineral processing studies were carried out during 1986.

FLUORSPAR

There are five significant fluorspar prospects in British Columbia located in the Omineca and Foreland belts. Only the Rock Candy showing in the southern Omineca belt has a production history.

GYPSUM

In British Columbia, gypsum has been produced from two areas: Falkland and the East Kootenays. There are two other lesser-known gypsum deposits: Forget-me-not Creek near the Alberta border, and O'Connor River near the Alaska panhandle where there has been some bulk sampling.

18. FALKLAND

Kamloops M.D. Lat. 50°30' Long.119°30' (82L/12E)

The mining area is located one kilometre north of Falkland, B.C., south of Kamloops, B.C.

The property is owned by Lafarge Canada Inc., R.R. #2, Site 12, Comp.1, Kamloops, B.C., V2C 2J3.

Gypsum with anhydrite occurs as a series of lenses along two parallel shear zones. The deposit is interpreted as intrusion from underlying sediments by plastic flow during folding and faulting. The

mineable gypsum was formed by hydration of anhydrite, which comprises the deeper parts of the deposits.

The deposit produced 1.25 million tonnes during continuous operation between 1913 and 1956 when the high grade gypsum was depleted. The quarry operated in 1983 and 1984, but was inactive during 1985. During 1986 and 1987, gypsum was mined from an open pit and transported by truck to the company's cement plant near Kamloops. Production amounted to 3710 tonnes in 1986 and 3885 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol. 1, 1975-1980, p.44; Mining in British Columbia, 1981-1985, pp.60-61; MI 82L/NW-1.

19. LUSSIER RIVER

Fort Steele M.D. Lat.50°02' Long.115°31' (82J/4E)

The mine is located on the east bank of the Lussier River, approximately 2.5 kilometres south of its confluence with Coyote Creek, at an elevation of 1,306 metres. Access is via a gravel road which leaves Highway 93/95 six kilometres south of Canal Flats. The crushing, screening and rail load facility is located in Canal Flats.

The mine is owned by Domtar Inc., 12509 116th Avenue, Surrey, B.C., V3V 3S6.

This well-bedded and firmly-laminated gypsum deposit occurs in the Burnais Formation which is thought to be middle Devonian in age. The deposit is covered by glacial till and outcrop in the general area is scarce. The deposit is lens-shaped and conforms to the same contour as the Lussier River valley. The deposit is contaminated by vertical limestone inclusions and clayey layers. At depth the gypsum gradually turns into a massive anhydrite.

This operation commenced in 1984. The deposit is drilled and blasted then transported to a load-out site at Canal Flats. The rock is reduced to minus 15 centimetres then shipped by rail to Domtar gypsum plants in Edmonton, Alberta, and Surrey, B.C. In 1986, access roads were constructed.

Total production was 180,180 tonnes in 1986 and 180,858 tonnes in 1987, with an average purity of 85% gypsum.
References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.59-60; MI 82J/SW-9.

20. WINDERMERE OPERATIONS

Golden M.D. Lat.50°29' Long.115°53' (82J/5W)

The property is located on the south fork of Windermere Creek, approximately 11 kilometres west of Invermere, B.C. Access is via road, which was upgraded in 1982 to join the Windermere quarry haul road.

The operation is owned by Westroc Industries Ltd., 2424 Lakeshore Road West, Mississauga, Ontario, L5J 1K4.

The gypsum deposit is part of the Burnais Formation evaporite sequence of Devonian age. The deposit becomes anhydrite at depth.

The operation includes two quarries, Elkhorn and Windermere, but most product now comes from the Elkhorn quarry. The gypsum is mined using conventional open pit methods. The blasted ore

is transported to the primary crusher then to the secondary crushing and loading facility located on a spur adjacent to the C.P. rail tracks. The products are shipped to markets in B.C., Alberta and Washington State via CP Rail and/or highway transport.

In 1986, production of gypsum was 414,570 tonnes mined and 396,300 tonnes shipped. Production for 1987 was 377,837 tonnes mined and 367,190 tonnes shipped.

JADE

Jade in British Columbia occurs as lenticular bodies associated with alpine-type serpentinite intrusions of mid-Paleozoic to Triassic age. Generally, jade pods occur along contacts with cherty rocks; to a lesser degree they occur with volcanic or plutonic rocks. The major deposits are at Mount Ogden in the central part of the province, and in the Cry Lake area in northern British Columbia.

21. CASSIAR

Liard M.D. Lat. 59°20' Long. 129°49' (104P/5W)

Jade is produced as a by-product at the Cassiar asbestos mine located on Mount McDame, approximately 4.8 kilometres north of Cassiar, B.C.

The property is owned by Cassiar Mining Corporation, 2000-1055 West Hastings Street, Vancouver, B.C. V6E 3V3.

22. CONTINENTAL JADE

Omineca M.D. Lat.55°50' Long.125°46' (93N/13W)

This mine is owned by a group of B.C. investors and operated by Jade West Resources Ltd., P.O. Box 126, White Rock, B.C., V4B 4Z7.

The property is located on the south side of Mount Ogden, approximately 120 kilometres northeast of Hazelton, B.C.

Ogden Mountain is the most famous jade property in B.C., with production since 1970. During 1987, the property was acquired by a group of local investors from foreign owners (Japanese Bank). Production in 1987 was 23,000 kgs, all of which was marketed in the People's Republic of China.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.45; Mining in British Columbia, 1981-1985, p.61; MI 93N-156,157.

23. FAR NORTH JADE

Omineca M.D. Lat.55°52' Long.125°50' (93N/13W)

The property is owned by Jade West Resources Ltd., P.O. Box 126, White Rock, B.C., V4B 4Z7.

The Far North group of claims is situated on the north side of Mount Ogden, approximately 120 kilometres northeast of Hazelton, B.C.

Production at this site was 100,000 kgs in 1986 and 115,000 kgs in 1987. The majority of product is marketed in the People's Republic of China, with the remainder distributed in Taiwan, Hong Kong, New Zealand and Canada.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.45; Mining in British Columbia, 1981-1985, p.61; MI 93N-165.

LIMESTONE

Some domestic limestone production is processed and used in British Columbia, while a significant tonnage is exported. The main B.C. production centre is in the northern part of Texada Island. The main market is the cement and lime industry in Vancouver, the Puget Sound area, and Portland, Oregon.

24. BENSON LAKE

Nanaimo M.D. Lat.50°30' Long.127°30' (92L)

This quarry is located three kilometres southwest of Benson Lake, Vancouver Island, near the intersection of the road from Benson Lake to Port Alice and the main logging road.

It is owned by International Marble and Stone Company Ltd. (IMASCO), 19287-98A Avenue, Surrey, B.C., V3T 4W2.

The white limestone is part of a thick section of generally grey coloured carbonate rocks of the Upper Triassic Quatsino Formation. Fresh, clean rock, uncontaminated by earthy soil, occurs between 0.5 metre to 1.0 metre below the surface. Three aplitic dykes crosscut the limestone. The limestone beds strike 120° and dip 30° northeast. About one third of the exposed beds are highly fractured while the rest is more massive and blocky.

A white, massive, fine-grained limestone is produced which is processed in the company's Surrey plant into different grades of fillers and extenders.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Geological Fieldwork, 1985, p.239; MI 92L-295

25. BLUBBER BAY

Nanaimo M.D. Lat.49°47' Long.124°37 (92F/15E)

The Blubber Bay quarry is located at the north end of Texada Island, one kilometre south of Blubber Bay.

It is owned by Ash Grove Cement West Inc., 300-5550 S.W. Macadam Avenue, Portland, Oregon, 97201.

The product is shipped to a new chemical rock processing plant located in Portland, Oregon, which was brought into operation in 1986. Production of processed limestone and chemical rock was 1,056,981 tonnes in 1986, and 1,046,011 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.46; Mining in British Columbia, 1981-1985, p.63; MI 92F-397.

26. COBBLE HILL

Victoria M.D. Lat.48°40' Long.123°37' (92B/12E)

The quarry is located on the southwest corner of Cobble Hill, three kilometres southwest of Cobble Hill Station, Vancouver Island.

In 1986, this quarry and the mill at Bamberton were purchased by A.R.M. Industries, Bamberton Road, Cobble Hill, B.C.

In 1986 and 1987, the quarry was reactivated on an intermittent basis to provide building and road material.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.45; Mining in British Columbia, 1981-1985, p.63; MI 92F-394.

27. DAHL LAKE

Cariboo M.D. Lat.53°47' Long.123°17' (93G/14W)

The quarry is located at the northeast corner of Dahl Lake, 35 kilometres southwest of Prince George.

The operation is owned by Northrock Industries, P.O. Box 518, Prince George, B.C.

The quarry supplies several local pulp and paper mills with a chemical-grade limestone. The company selectively mines high-grade parts of the larger limestone body which is locally contaminated by intrusive dykes and siliceous zones.

Reference: *Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.47; Mining in British Columbia 1981-1985, p.65; MI 93G-32.

28. HARPER RANCH

Kamloops M.D. Lat.50°40' Long.120°03' (92I/9E)

The quarry is situated on the north side of the South Thompson River, approximately 25 kilometres east of the City of Kamloops. It is approximately one kilometre north of the cement plant which is accessible by public road from the Trans-Canada Highway.

It is owned and operated by Canada Cement Lafarge Ltd., 1051 Main Street, Vancouver, B.C., V9A 2V9.
During the 1986-1987 period the quarry produced 269,117 tonnes of limestone.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.46; Mining in British Columbia, 1981-1985, p.65; MI 92I/NE-1.

29. IDEAL

Nanaimo M.D. Lat.49°49' Long.124°33' (92F/10E)

The Ideal quarry is located on the north end of Texada Island, four kilometres south of Vananda.

It is owned and operated by Ideal Basic Industries Ltd., Rock Products Division, 610-1200 West Pender Street, Vancouver, B.C., V6E 2S9.

This quarry operated during the 1986-1987 period, producing 1,552,152 tonnes of limestone in 1986, and 2,329,810 tonnes in 1987. A significant portion of the plant equipment operated on an occasional basis only.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.46; Mining in British Columbia, 1981-1985, p.64; MI 92F-395.

30. IMPERIAL

Nanaimo M.D. Lat.49°44' Long.124°32' (92F/10E)

The Imperial quarry is located on the north end of Texada Island, 3.2 kilometres southeast of Vananda.

The quarry is owned by J.A. Jack & Sons Inc., 5427 Ohio Avenue South, Seattle, Washington, 98134, and is operated by Imperial Limestone Company Ltd. of the same address.

The Imperial quarry operated throughout the 1986-1987 period. Operations included selective mining of white limestone for filler and extender applications. Total limestone quarried was 179,669 tonnes in 1986 and 140,828 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.45; Mining in British Columbia, 1981-1985, p.63; MI 92F-394.

31. LOST CREEK

Nelson M.D. Lat.49° Long.117° (82F)

The mine is located on the west side of Lost Creek, three kilometres north of Highway 3 between Salmo and Creston, B.C.

It is owned by International Marble and Stone Company Ltd. (IMASCO), 19287-98A Avenue, Surrey, B.C., V3T 4W2.

The mine is a horizontal adit in a massive limestone band within the Reeves Member of the Cambrian Laib Formation. The limestone strikes 60° and dips 45° southeast. The end of the 60-metre long adit intersects zones light grey in colour and others with dark grey streaks.

This underground operation opened in 1982. White, fine-grained crystalline limestone of a sugary texture, mottled in places by yellow, is mined. The mined rock is trucked to IMASCO's plant at Sirdar, B.C. where it is ground into a variety of industrial limestone products.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Geological Fieldwork, 1985, p.240; MI 82F/SW-307

32. PAVILION LAKE (Marble Canyon)

Kamloops M.D. Lat.50°49' Long.121°39' (92I/13E)

The quarry is located on Marble Canyon Indian Reserve No.3, and Pavilion Indian Reserves Nos.3A and 4, 37 kilometres by road northwest of Cache Creek, B.C.

The land is owned by the Pavilion Indian Band; the plant and equipment are owned and operated by Continental Lime Limited (formerly Steel Brothers of Canada Limited) 215-10451 Shellbridge Way, Richmond, B.C., V6X 2W8.

The chemical-grade high calcium limestone is crushed and sized, and the minus five plus one centimetre product is fired in an oil-fired rotary kiln for calcining. The resulting calcium oxide is transferred to storage bins for sale, but can be custom crushed and rescreened to meet customer specification.

In 1986 and 1987 approximately 338,500 tonnes of limestone was quarried, crushed and screened; kiln production was 137,000 tonnes of calcium oxide. During this period an access road was constructed above the existing quarry, and development started at the 1082m elevation.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.47.; Mining in British Columbia, 1981-1985, pp.64-65; MI 92I/NW-81.

33. PURDEN LAKE

Cariboo M.D. Lat.53°50' Long.121°50' (93H/13)

The property is located approximately 60 kilometres east of Prince George, B.C.

The quarry was operated on an as-required basis throughout the period by Quesnel Ready-Mix.

34. VANANDA

Nanaimo M.D. Lat.49°45' Long.124°31' (92F/10E)

The Vananda quarry is located on the north coast of Texada Island, 1.6 kilometres southeast of Vananda.

It is owned and operated by Canada Cement Lafarge Ltd. (Pacific Region), 1051 Main Street, Vancouver, B.C., V9A 2V9.

After suffering declining production and workforce during 1981-1985, the quarry closed in early 1986.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.45; Mining in British Columbia, 1981-1985, p.64; MI 92F-396.

Other past-producers of limestone include **Baker Creek** operated by **Prime Lime and Marble Ltd.**, 80 kilometres south of Chetwynd, B.C.; **Bowron Creek** operated by **Western Lime and Marble Inc.**; **Redrocky Creek** operated by **Tri-Lime Resources Ltd.**; and **Ptarmigan Creek** operated by **Quesnel Ready-Mix.**

MAGNESITE

All economically important magnesite occurrences in carbonate rocks are near the Rocky Mountain Trench, both on the eastern and western sides. While some occurrences have sedimentary characteristics, others seem to be replacement deposits. Stratigraphically, the southern and northern occurrences are in Lower Cambrian rocks, the largest deposit (Cross River) is in Middle Cambrian carbonate rocks, and occurrences near Brisco are in Late Proterozoic rocks of the Upper Purcell Mount Nelson Group.

35. MOUNT BRUSSILOFF

Golden M.D. Lat.50°47' Long.115°41' (82J/13E)

The mine is located near Mount Eon, one kilometre north of the confluence of, and between, Mitchell River and Assiniboine Creek. Access is via Highway 93 from Radium to Settlers Road, thence by the Palliser Road to Cross River Road, and by the Mitchell River Road to the mine, approximately 65 kilometres from Radium, B.C.

The mine is owned and operated by Baymag Mines Co. Ltd., 200-1144 29th Avenue, Calgary, Alberta, T2E 7P1.

This coarsely crystalline, white to grey, magnesite deposit occurs within the Cathedral Formation carbonates. The magnesite has some contaminants, mainly dolomite and pyrite, which occur erratically, requiring close grade control and selective mining.

This open pit operation began production in 1982. Top soil and overburden are stripped, then the ore is drilled, blasted, and transported to the crushing and screening plant. The ore is shipped to Baymag's calcinating facility at Exshaw, Alberta for further processing. The major products are caustic magnesia and electrically fused periclase. In 1987 an exploration program was undertaken in the area of the present pit to further outline mineable reserves.

Total ore produced and shipped for processing was 124,438 tonnes in 1986 and 141,390 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.66-67; MI 82J/NW-1.

MAGNETITE

Approximately 50,000 tonnes/year of magnetite is produced from tailings at the former Craigmont mine, 16 kilometres northwest of Merritt, B.C., by Craigmont Mines Ltd. (of M. Seven Industries Inc.) 820-355 Burrard Street, Vancouver, B.C., V6C 2G8. All production is used in coal processing plants in Western Canada and Centralia, Washington.

MARL

36. CHEAM MARL

New Westminster M.D. Lat.49°11' Long.121°44' (92H/4E)

The operation is located at Cheam Lake, near Popkum, B.C.

It is owned by Cheam Marl Products Ltd., 13 Fletcher Street South, Chilliwack, B.C.

The deposit of marl is two to three metres thick, and is overlain by a metre or so of clayey overburden. The deposit was formed by deposition of lime marl (minute shellfish) on the bed of Cheam Lake during the post-glacial period. The lake was drained, and mining of marl commenced in 1952.

Production of marl ended in 1986 in the Cheam Lake area, and the lease reverted to the Crown. Fraser Cheam Regional District initiated a reclamation program involving Ducks Unlimited. During 1987, site activity was on private land, with marl being stockpiled in the area.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.47; Mining in British Columbia, 1981-1985, p.67; MI 92H/SW-106.

MICA

There was renewed interest in the mica prospect near Valemount, B.C. Outland Resources Corp. reopened old trenches and conducted bulk sampling of the high-mica schist on the Canoe claims.

PERLITE

There are several known occurrences of volcanic glass throughout the province. Mount Meager, north of Pemberton, and Terrace Mountain near Vernon are easily accessible, while Empire Valley and occurrences to the south and west of Burns Lake are in more remote locations. Prior to the Frenier mine all perlite used in Canada was imported, the British Columbia market being serviced by Oregon.

37. FRENIER (EMPIRE VALLEY)

Clinton, M.D. Lat.51°20' Long.122°21' (92O/8W)

The property is located near Higginbottom Creek in the Empire Valley, five kilometres west of the Fraser River, and 60 kilometres northwest of Clinton, B.C. Access is via road from Highway 97.

The Frenier mine is owned and operated by Aurun Mines Ltd., P.O. Box 602, Aldergrove, B.C., V0X 1A0.

This perlite deposit occurs in two zones. It forms part of a felsic volcanic sequence, centred in the Blackdome Mountain area. Overburden is generally less than 0.7 metres thick.

The deposit is mined by open pit method, ripping and dozing in benches one metre high. The perlite is loaded into road haulage trucks, hauled to a stockpile near White Lake, then transported to the processing plant located in Surrey, B.C. During 1986 and 1987, 2500 tonnes of perlite were produced.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, 1981-1985, pp.67-68; MI 92O-72.

PYROPHYLITE

A small amount of pyrophylite is produced on an intermittent basis at **Princeton**, B.C. by Clayburn Industries Ltd., 33765 Pine Street, Abbortsford, B.C., V2S 5C1. Pyrophylite is used in ceramics and refractories, and may be substituted for talc in some pulp and paper applications.

RHODONITE

A small quantity of rhodonite came onto the market from deposits at **Hill 60** near Duncan, B.C., and from **Arthur Point** south of Bella Coola, B.C. The stone is processed into jewelry and some is shipped abroad.

SILICA

There are several different types of silica resources in B.C.: quartz conglomerate at Sumas Mountain near Abbotsford; a devitrified rhyolite ash at Barnhard Vale near Kamloops; a massive, Ordovician Mt. Wilson (Wonah) quartzite near Golden; and a pegmatitic plug at Oliver.

38. BUSE LAKE

Kamloops M.D. Lat.50°37' Long.120°01' (92I/9E)

The cement plant is located on the north bank of the South Thompson river, approximately 17.5 kilometres east of Kamloops, B.C. The quarry is at Buse Lake, 11 kilometres south of the plant.

The operation is owned by Lafarge Canada Inc., 1051 Main Street, Vancouver, B.C., V6A 2V9, and operated under contract by Plateau Construction Ltd. of Kamloops.

The deposit is a Miocene tuff of the Tranquille Formation. Rock is blasted and hauled to the crushing station at the company's Harper Ranch quarry.

Production for 1986-1987 was 17,535 tonnes.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.48; Mining in British Columbia, 1981-1985, p.68; MI 92I/NE-123.

39. HORSE CREEK SILICA

Golden M.D. Lat.51°13' Long.116°50' (82N/2W)

The crushing, screening and rail loadout facility is situated just west of Highway 95, eleven kilometres south of Golden, B.C. at Horse Creek. The mine is approximately two kilometres east of the plant.

The property is owned by the Coastal Mining Co. of Canada, c/o Davis & Co., 1030 West Georgia Street, Vancouver, B.C., V6E 3Z2, and operated by Bert Miller Trucking, P.O. Box 744, Golden, B.C., V0A 1H0.
Silica is mined from quartzite of the Mount Wilson formation.

This is an open pit mine and processing plant which started production in 1982. After removing trees and minimal overburden stripping, the rock is drilled and blasted, and transported to the crushing, screening, washing and loadout facility. It is then shipped out by rail. Approximately 67,000 tonnes was produced in 1986, and 74,000 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.48; Mining in British Columbia, 1981-1985, p.70; MI 82N-43.

40. MOBERLY SILICA

Golden M.D. Lat.51°22' Long.116°57' (82N/7W)

The mine is located approximately ten kilometres northwest of Golden, B.C. at an elevation of 1,500 metres. Access from Golden is via the Upper Donald Road and the mine haul road. The plant is located ten kilometres west of Golden, on the TransCanada Highway at an elevation of approximately 1,000 metres.
The mine is owned by Mountain Minerals Limited, 714-5th Avenue South, Lethbridge, Alberta. T1J 0V1.

A major body of friable sandstone occur within Ordovician Mount Wilson Formation quartzites, which strike southeast at 125° and dip 75-90° degrees northwest. The silica deposit which is presently being mined occurs in a sandstone bed over 200 metres thick.

This operation includes an open pit mine, which began production in 1980, and a processing plant. The ore is crushed, screened and washed to produce high purity silica sand. The sand is shipped by rail and truck to customers in Alberta and B.C. Its major uses are for foundry sand, sandblasting sand, glass-making sand and golf course sand.

A new mine haulage road, and work on upgrading the crusher, was completed in April, 1986. Construction of a mine road extension was begun in September, 1986 and completed in June, 1987. The operation produced 80,000-100,000 tonnes per season.

References: *B.C.Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.48; Mining in British Columbia, 1981-1985, pp.69-70; MI 82N-1.

41. PACIFIC SILICA (OLIVER)

Osoyoos M.D. Lat.49°12' Long.119°33' (82E/4E)

Pacific Silica is located one kilometre north of Oliver, B.C., on Highway 97.

The quarry is owned by Pacific Silica Ltd., Box 39, Oliver, B.C., V0H 1T0.

During 1986 and 1987 no new material was produced. The company reclaimed and marketed reject quartz silica left from previous operations. About 7600 tonnes of material was shipped in 1986, and 6349 tonnes in 1987.

References: *B.C. Ministry of Energy, Mines & Pet. Res.*, Mining in British Columbia, Vol.1, 1975-1980, p.48; Mining in British Columbia, 1981-1985, p.69; MI 82E/SW-84.

SULPHUR

Sulphur is an important industrial mineral in terms of value. Recorded production includes the estimated sulphur content of pyrite shipped, plus the sulphur contained in sulphuric acid made from waste smelter gases. Elemental sulphur has been recovered from the Westcoast Transmission Co. Ltd. plant at Taylor since 1958, and from the Petrosul International Ltd. plant at Fort Nelson since 1978. In addition, sulphuric acid is produced at the Cominco plant in Trail.

Total sulphur production in B.C. was 501,459 tonnes in 1986 and 505,831 tonnes in 1987.

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